MACHINERY

Design—Construction—Operation

Volume 42 | JUNE, 1936 | Number 10

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***Air-Conditioning* has invaded the machine shop. When a shop department is air-conditioned to insure more accurate work, it is news. As will be described in the leading article in July MACHINERY, the Ford Motor Co. finds that air-conditioning in the shop, foundry and factory offices pays in dollars and cents, as well as in health and comfort of the workers.**

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PUBLISHED MONTHLY BY

THE INDUSTRIAL PRESS

148 Lafayette Street New York

ROBERT B. LUCHARS ....*President*
EDGAR A. BECKER..*Vice-pres. and Treasurer*
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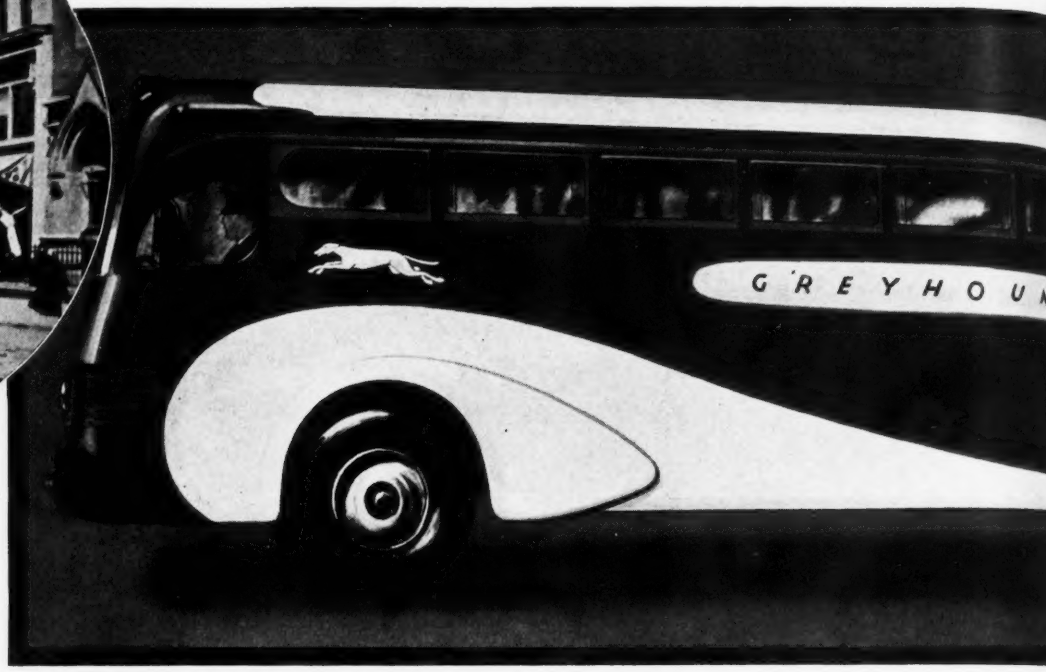
LONDON: 52-54 High Holborn
PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents.
Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue.
Send old as well as new address.

Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America. Member of A.B.P. Member of A.B.C.

CIRCULATION 15,238



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"What a whale of a difference a few years make

The above two photos indicate a striking contrast in public transportation. The large aero-dynamic, ultra-comfortable Greyhound for 1936 adequately typifies the advancements over the old, horse-drawn cars. Small wonder that America is decidedly travel conscious!

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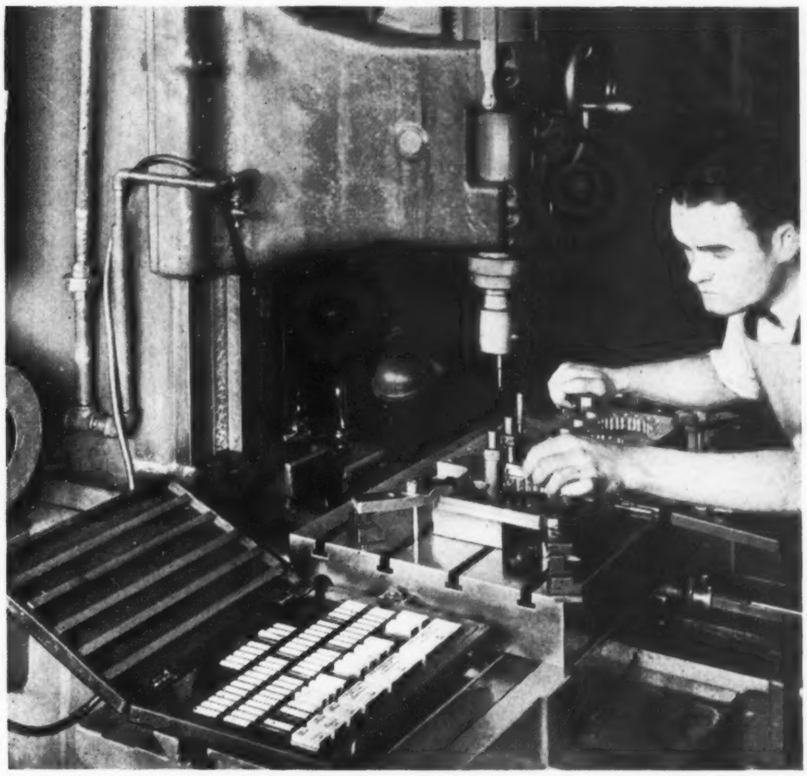
LODGE & SHIP

MACHINERY

Volume 42 NEW YORK, JUNE, 1936 Number 10

Extensive Use of Gage-Blocks Insures Ford Accuracy



The Thousands upon Thousands of Gages, Tools and Jigs Used in Ford Plants Must Conform to Measurement Standards that Far Surpass "Hair-Line" Accuracy

By CHARLES O. HERB

ONE hundred and eighty-six measurements on parts that are assembled in Ford automobiles must be within 0.0005 inch of the specified size, and quite a few of these measurements must be accurate within 0.0001 inch. How close such limits are will be realized by comparing them with the thickness of the average human hair, which is 0.003 inch. When a part must be true to size within 0.0001 inch, the allowance for error is only one-thirtieth the thickness of a human hair!

Hundreds of thousands of gages, tools, jigs, and fixtures are used in Ford plants to insure that all parts will be finished within the specified limits of accuracy—at the Rouge plant there are over 85,000 gages alone. The accuracy of these tools and gages must, of course, be considerably closer than the limits specified on the work-pieces for which they

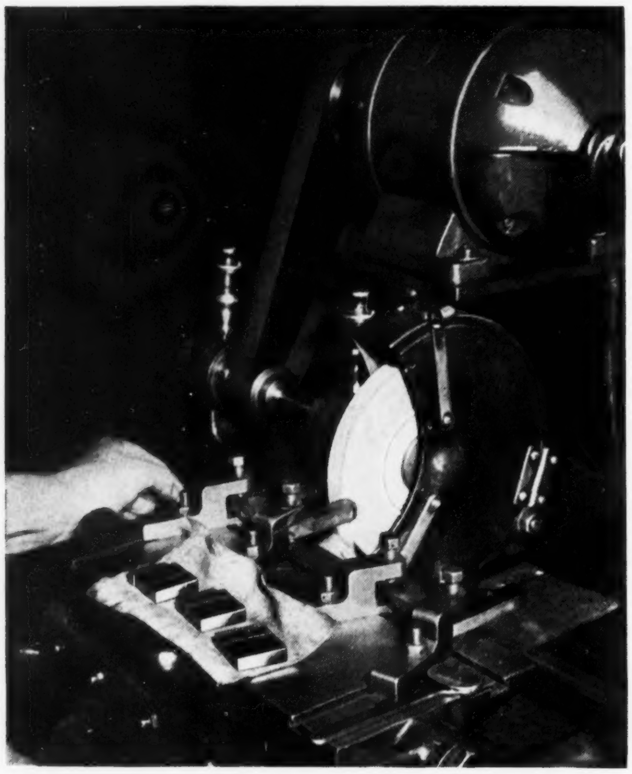
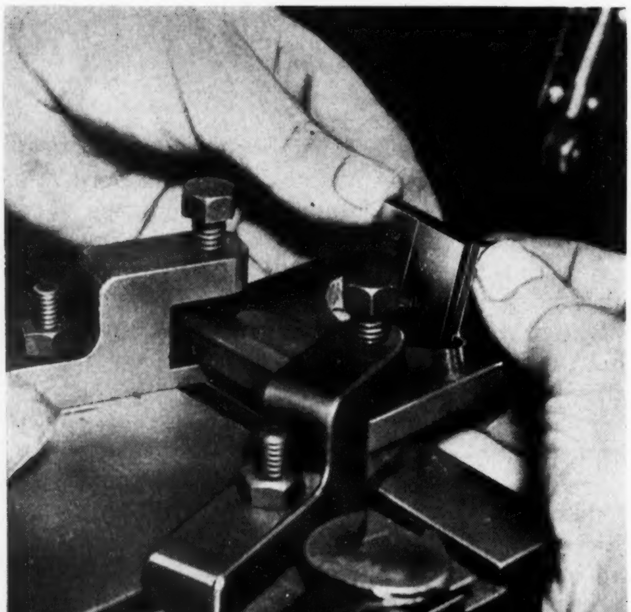


Fig. 1. Gage-blocks Accurate within Eight Millionths of an Inch are Used Right at the Machine in Grinding Ford Snap Gages

Fig. 2. Applying Precision Gage-blocks to Check a Snap Gage while it is Set up in a Grinding Machine



are intended. Hence the accuracy of the gages, tools, and jigs is controlled through the extensive use of Johansson gage-blocks. For example, at the Waterford, Mich., plant of the Ford Motor Co., where from sixty to seventy toolmakers are employed, there are thirteen sets of eighty-one gage-blocks each in constant use, as well as many gage-block accessories.

Johansson gage-blocks are made to three standards of accuracy, as follows: Blocks AA are accurate to within plus or minus two millionths inch at a temperature of 68 degrees F.; blocks A are accurate to within plus or minus four millionths inch; and blocks B are accurate to within eight millionths inch (about one four-hundredth the thickness of a human hair). Gage-blocks of B quality are ordinarily used in tool-rooms, grade A is used for inspection work, and grade AA is intended primarily for application in physical laboratories. Typical applications of Johansson gage-blocks in the Waterford plant are described in the following.

Checking Snap Gages Right at the Grinding Machine

Snap gages of the solid type are required in large numbers by the Ford plants. Their inspection surfaces are chromium-plated, which greatly increases their life, and they are ground and lapped to the required dimensions after plating. When the plating wears beyond the specified tolerance, the gages are replated and again ground and lapped. This procedure is followed indefinitely.

A machine set up for grinding "Go" and "No Go" snap gages is shown in Fig. 1. Three combinations of gage-blocks are lying on the machine carriage. All three combinations are used to check either the "Go" or "No Go" snap gages, whichever the gage-maker happens to be grinding at the time. As material is ground off and the opening between the jaws becomes larger, a larger gage-block combination is needed for checking. Instead of replacing one block in a combination with another 0.0001 inch or so larger in thickness, the toolmaker merely applies a larger combination already made up. Then as the opening between the jaws is ground still larger, the gage-maker applies the third combination until the snap gage is ground as specified. The snap gage then goes to a man who laps it to the required size.

The method of applying these gage-block combinations to a snap gage is illustrated in Fig. 2. It will be seen that three gage-blocks are wrung together to obtain a width corresponding to the required dimension between the "No Go" surfaces of the gage.

Gage-blocks are commonly used in setting up various adjustable inspection devices. Fig. 3, for example, shows three gage-blocks being employed to position the contact point of an optical inspection instrument. Fig. 4 illustrates an amplifying gage being used to check a master thread gage by

the three-wire method. The distance between the upper contact point of the amplifying gage and the block on which two of the wires are supported, was previously established by applying the four gage-blocks that are seen lying on the table. The amplifying gage indicates the amount that the thread gage varies from the specified pitch diameter.

Adjustable Holders and Other Accessories Widen the Applications of Gage-Blocks

Various accessories can be obtained for use with the gage-blocks that greatly widen their applications. Adjustable holders are available in which the gage-blocks can be built up to required heights. By providing a foot-piece for one of these holders, a precision height gage is obtained. Different jaws can be used in the holders in combination with the gage-blocks for obtaining temporary gages suitable for the checking of external or internal surfaces. Scribers are available which can be applied in the holders for marking parts at specified heights, and there are sine bars for use in checking angular surfaces. Center points can be obtained for mounting in an adjustable holder when the distance between threads, etc., must be determined.

In Fig. 5 is illustrated a height gage made up by mounting an adjustable holder in a foot-block. Positioned in the holder at a height determined by using three gage-blocks is a scriber. The illustration shows this scriber being used to mark a line around a cylindrical part that has been coated with etching ground.

Checking the Splines and Taper of Gages

The use of gage-blocks and their accessories facilitates the accurate checking of splines, as will be apparent from Fig. 6. In this illustration, a temporary snap gage has been made up by inserting two jaws with flat measuring surfaces in an adjustable holder. Two gage-blocks placed between the jaws insure that they are separated the specified distance.

Sine bars with an accuracy of either 0.00002 or 0.00001 inch per inch of length are available for determining the taper of parts. A typical sine bar application is illustrated in Fig. 7, which shows a set-up for inspecting the taper of a plug gage. It will be seen that the sine bar is inclined at the desired angle by placing three gage-blocks beneath the left-hand cylindrical plug attached to the end of the sine bar. This plug is backed up by a vertical surface plate.

With the sine bar inclined at the angle corresponding to the taper of the plug gage to be inspected, it will be evident that the tapered surface on the top side of the gage should be parallel with the surface plate when the gage is laid on the sine bar as shown. The amount that the gage surface deviates from being parallel with the surface plate and, therefore, the degree of inaccuracy, can be

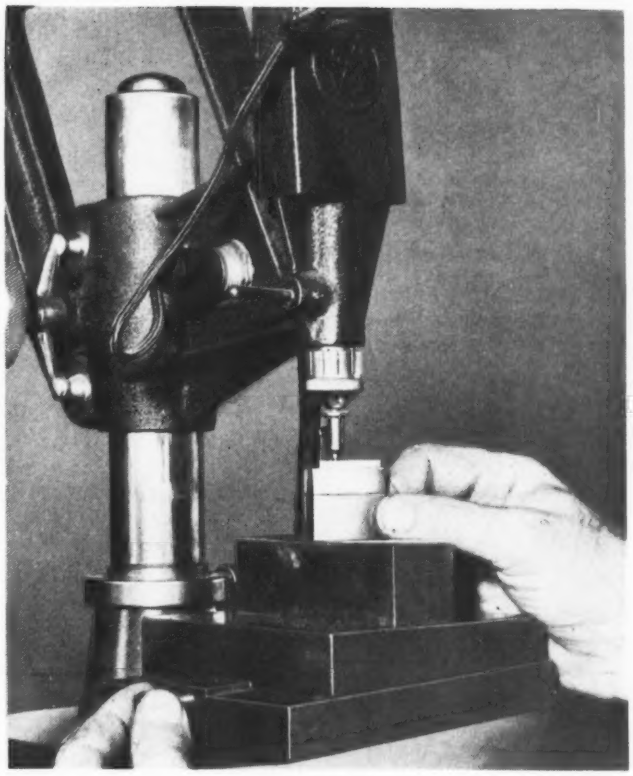


Fig. 3. Accurate Settings of Optical Inspection Devices are Facilitated by the Use of Precision Gage-blocks, as Shown

Fig. 4. Gage-blocks Provide a Convenient Method of Adjusting Amplifying Gages for Precision Inspection

Fig. 5. (Below) Using Gage-blocks and an Accurate Scriber in a Holder to Mark a Line at a Specified Height

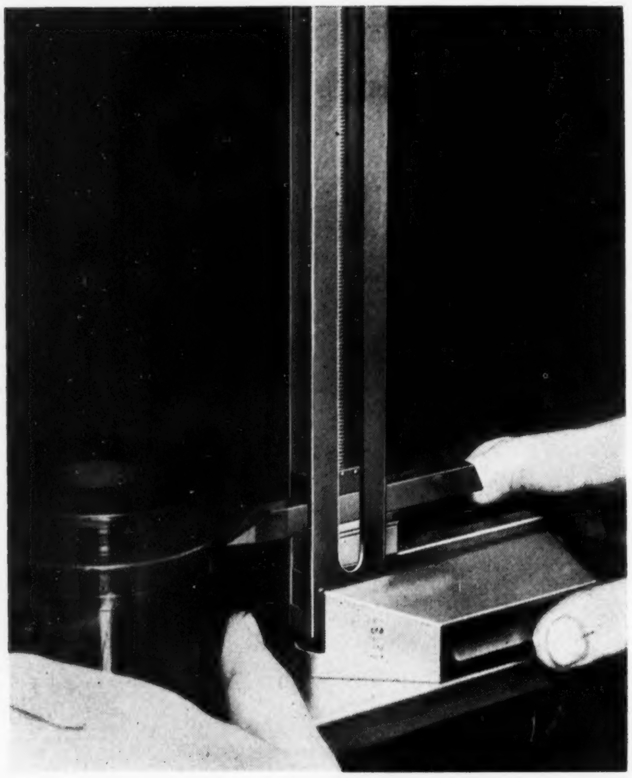
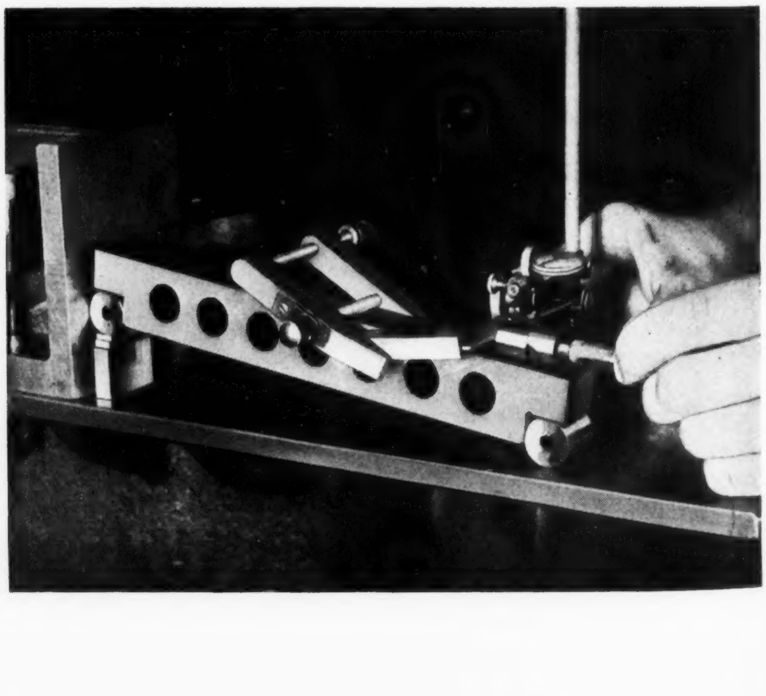


Fig. 6. (Above) Gage-blocks and Precision Jaws in an Adjustable Holder Provide a Temporary Snap Gage

Fig. 7. (Right) Using Gage-blocks in Combination with a Sine Bar to Check the Taper of a Plug Gage



determined by running an indicator attached to a height gage along the tapered gage surface. The clamp seen in the illustration is used merely to hold a straightedge in place to insure that the plug gage will be held in proper alignment as the indicator is applied.

Gage-blocks with the edges finished to various angles are obtainable for use in combination with the length type gage-blocks for checking angular surfaces in relation to each other. One or more "angle" gage-blocks can be used together.

A convenient method of setting an indicator gage employed in checking the diameter of holes in ring gages is illustrated in Fig. 8. Two adjustable gage-block holders are used together for clamping accurate parallel bars spaced apart a distance corresponding to the diameter of the hole to be checked. A combination of three gage-blocks, wrung together to obtain this dimension, were placed between the parallel bars, after which the adjusting screws of the holders were tightened to make the setting secure. By placing the indicator and anvil of the inspection device between the parallel bars, the instrument can be conveniently and accurately set to suit the ring gage to be checked.

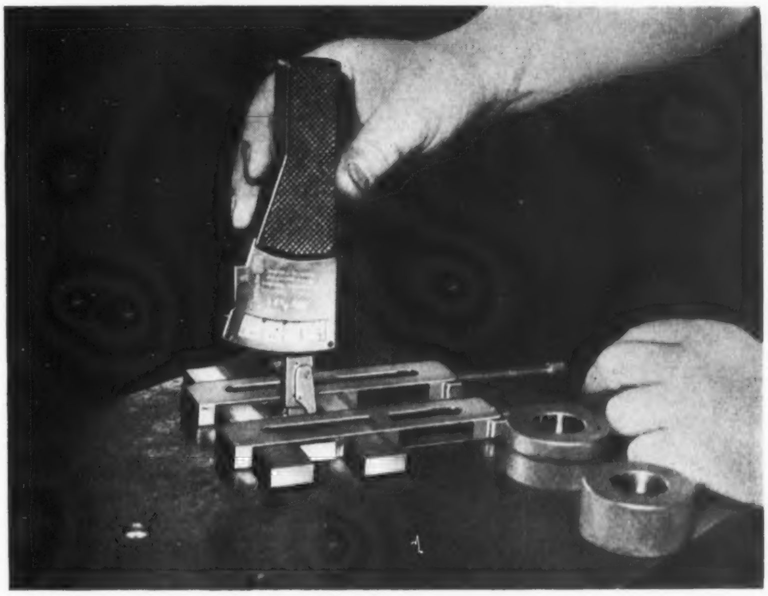


Fig. 8. Gage-blocks, Parallel Bars, and Adjustable Holders being Used Together to Obtain an Accurate Setting of an Indicator Gage

Precision gage-blocks have become invaluable in attaining accuracy not only in the automotive industry, but also in industrial plants engaged in the manufacture of ball bearings, weighing scales, sewing machines, cream separators, and electrical equipment—or wherever measurements must be precise.

* * *

For decades American business has acquiesced in unscientific and inequitable methods of taxation. Having sown the wind, we are now reaping the whirlwind, with the present government applying wholly confiscatory methods.

National Metal Exposition in Cleveland

The annual Metal Exposition, to be held in the Public Auditorium, Cleveland, Ohio, October 19 to 23, under the auspices of the American Society for Metals, promises to be one of the largest shows, if not the largest, sponsored by the Society. Eighty-five per cent of the exhibit space in the huge exhibit hall has been contracted for by exhibitors. Early in May, 115 companies, a great many of whom are leaders in their field, had reserved 55,000 square feet of exhibition space. Steps are being taken to obtain additional space. It is significant that almost all of the 115 concerns who have taken space have increased their space requirements over that used a year ago.

As in past years, the National Metal Congress will be held in conjunction with the Metal Show. The technical sessions promise to be especially broad in their interest, since more societies will take part in the 1936 congress than formerly. In addition to the American Society for Metals, the following national societies will cooperate: The Wire Association; the Institute of Metals, and the Iron and Steel Divisions of the American Institute of Mining and Metallurgical Engineers; the American Welding Society; and the Machine Shop Practice, and the Iron and Steel Divisions of the American Society of Mechanical Engineers.

* * *

A paper mill was faced with a large expenditure for replacing a number of rolls, 23 inches in diameter, which had become too short for service. According to *Oxy-Acetylene Tips*, an oxy-acetylene service operator showed how disks could be bronze-welded on the ends at a cost of only $70, as against about $3000 for complete replacement.

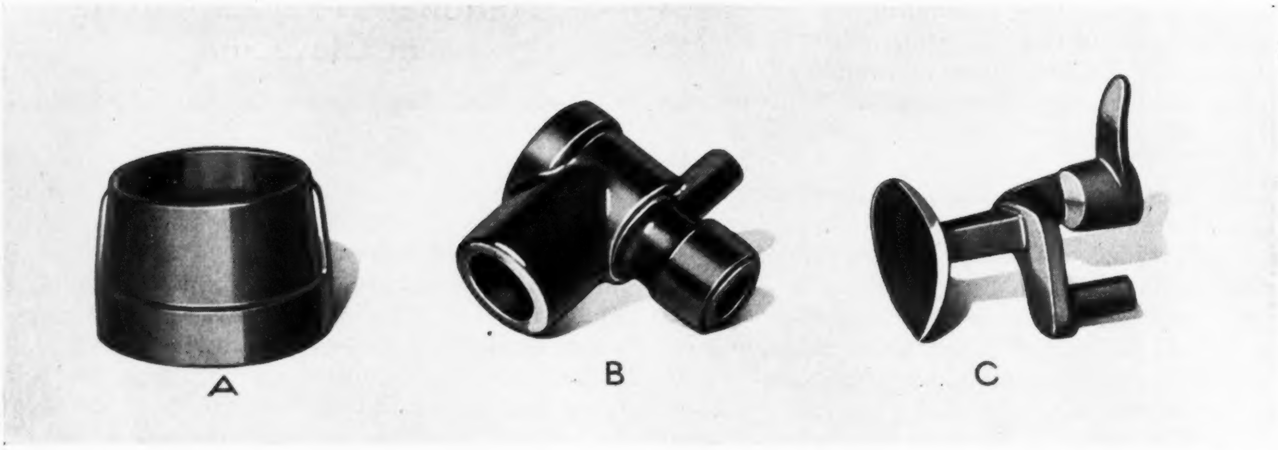


Fig. 1. Brass Die-castings Produced by Employing Fixed or Sliding Cores

The Dies Used in Brass Die-Casting

To Obtain Long Life, They Must be Made of Heat-Treated High-Grade Steels, Preheated at the Beginning of Each Run, Cooled with Running Water, and Polished Daily

By CHARLES O. HERB

BRASS die-casting, as done by one of the American pioneers in that field—the Titan Metal Mfg. Co., Bellefonte, Pa.—was described in an article published in February MACHINERY. That article dealt with the Polak machines used by the concern, and compared the advantages of brass die-castings with those of sand castings and forgings. That article did not, however, deal with the dies, and these are, after all, perhaps the most important factor in successful die-casting of any metal. How dies should be made for brass die-casting and how they should be taken care of to insure long life will be considered in this article.

To withstand the temperatures involved in die-casting copper-base alloys, it is necessary to make the dies from a steel of the semi high-speed type. One of the steels that has been found most satisfactory by the Titan Metal Mfg. Co. for die-casting dies has the following analysis: Tungsten, from 10 to 12 per cent; carbon, from 0.30 to 0.40 per cent; chromium, 1.75 per cent; and vanadium, 0.50 per cent. This steel is heat-treated to develop its heat-resisting properties.

The life of the dies used for casting brass depends also on the shape of the parts, their weight, and the quality of finish required. If check marks are not objectionable on the die-castings, the dies can, of course, be used for a much longer period than if the surfaces of the parts must be of high quality. Some dies have lasted for as many as 120,000 castings, but the average die life is about 30,000 castings.

Good care of the dies is most essential to insure a satisfactory life. The heat of the operation neces-

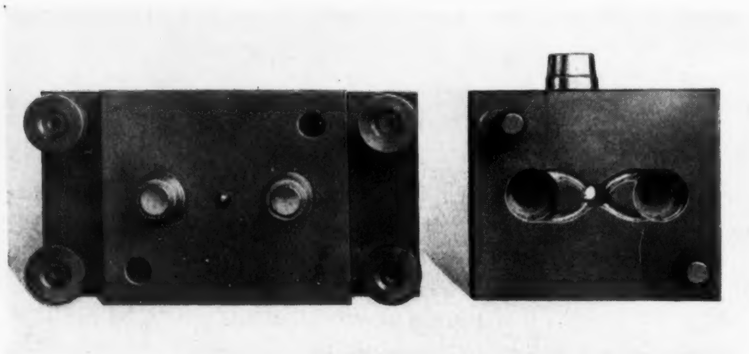


Fig. 2. Die-casting Dies of Comparatively Simple Design Employed for Producing Brass Couplings of the Type Shown at A, Fig. 1

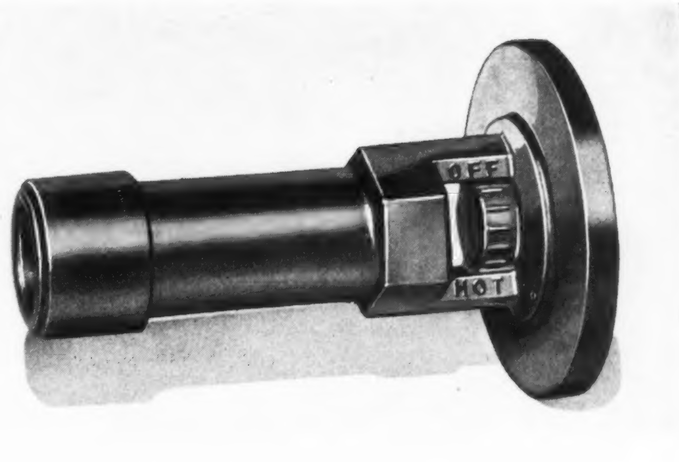


Fig. 3. A Brass Die-casting which is Cored to a Diameter of 15/16 Inch for a Depth of 3 Inches in One End

sitates that the dies be cooled; but if cold water were employed directly on the dies, they would crack. Hence, it is the practice of the concern to circulate water through channels which run transversely and vertically through plates immediately in back of the steel die-blocks. It is desirable to prevent the dies from becoming hotter than 600 degrees F., even though the metal being worked has a temperature of almost 1700 degrees F.

Another important point is that no attempt should be made to produce castings when the dies are cold. A gas line is connected to each die-casting machine in such a way that flames can be directed against the face of both the movable and the stationary die members before starting a new run of castings, so as to heat the dies to between 300 and 400 degrees F. This is done each morning before the machines are placed in operation.

In the production of brass die-castings, oxide forms on the die faces. The thickness of the oxide at the end of a day's run may be as much as 0.003 inch. It is the practice to scrape off the oxide at the end of each day and repolish all surfaces of the die cavities. To reduce the formation of oxide, the face of the stationary die is swabbed with tallow after every few "shots."

Essential Details of the Die Design

The dies used in casting brass are similar in construction to those used for casting other metals, such as zinc and aluminum. However, there are certain differences, due primarily to the manner in which the plastic metal is forced into the die cavities. Venting is of importance in the production of some parts. However, there is generally sufficient leakage of air between the die faces to enable the air to escape readily from the die cavities when the plastic metal is forced into them. The gating depends upon the nature of the piece being cast and upon the number of cavities in the dies. When castings require a shank, the dies can often be so designed that the shank will serve as a gate. In such cases, no separate trimming operation is required on the shank, since it is cut to length by the ejector in the compression chamber of the die-casting machine, as explained in the previous article.

Fig. 2 shows a simple set of dies used for producing hose couplings of the type seen at *A*, Fig. 1. These couplings are 1 15/16 inches maximum outside diameter by 1 3/8 inches long. They have a wall varying in thickness from 1/16 to 1/8 inch, the couplings being tapered both inside and outside. The two plugs on the movable die seen at the left in Fig. 2, which enter the cavities of the stationary die at the right, serve as cores for these parts. These two cores project through a plate which strips the die-castings from the plugs as the movable die reaches the end of its opening stroke. This stripping action is effected through adjustable horizontal bars on the sides of the machine.

It is the practice to make the working end of all cores readily replaceable, because these ends become red-hot in operation, and, in consequence, often have a short life. Two pilot-pins on the stationary die enter holes in the movable die as the dies are closed, thus accurately registering the two die members for each operation. It will be seen that two gates lead to each of the die cavities in the stationary member; this insures that the deep narrow cavities will be completely filled with the plastic metal before it starts to solidify. The length of the gate opening at the point where it connects with the die cavity depends on the nature of the casting. The width or height of the gate at the edges of a cavity is made about 0.030 inch.

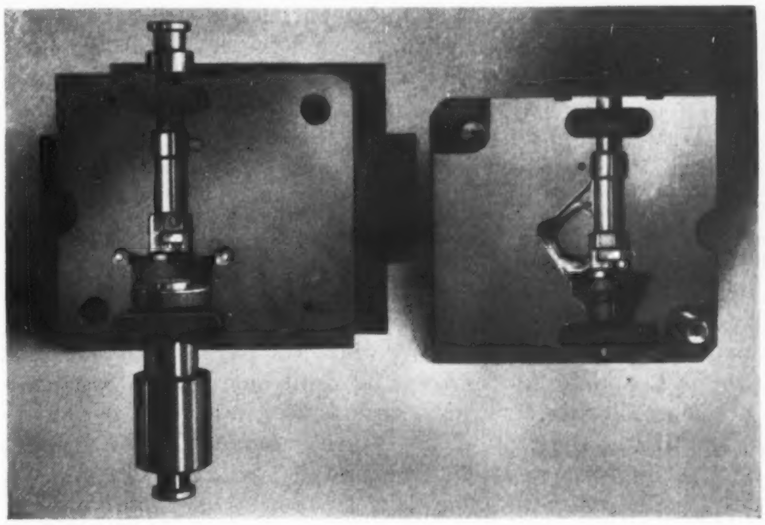
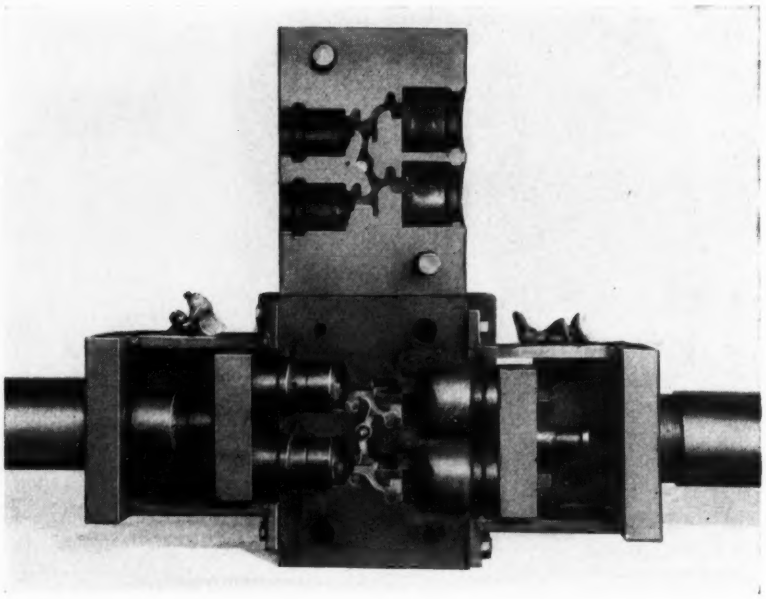


Fig. 4. Hydraulic Core-pulling Heads are a Feature of the Dies that Produce the Casting Illustrated in Fig. 3

Fig. 5. Construction of the Dies Used in Casting the Part Shown at C, Fig. 1, which Must be Produced with a Knife-edge along the Bowl-shaped End



Die with Two Vertical Sliding Cores

A brass die-casting of more than ordinary interest is illustrated in Fig. 3. This piece is about 4 3/4 inches long by 3 inches in diameter at the flange end. It has a cored hole in the opposite end, 15/16 inch in diameter by 3 inches long. There is also a small rectangular opening completely through the piece adjacent to the flange. In addition, two recesses and a center hole are cored in the flange end. The dies designed to produce this casting, which weighs 27 ounces, are shown in Fig. 4.

Hydraulic core-pulling heads are employed to operate sliding cores on the movable die for producing the cored hole and the recesses in the opposite ends of this casting. The dies were photographed while resting on a bench in the same position in which they are mounted in the machine—that is, with the hydraulic core-pulling heads vertical. The lower core-pulling head is shown in place, but the upper head was removed at the time the picture was taken.

The top head is used to operate the long core, and obviously, this core must have a movement slightly greater than 3 inches in order to release the die-casting. On cores, the practice is to allow a draft amounting to only about 1/4 degree. The core at the bottom of the dies that produces the recesses and center hole in the flange has a movement of about 1 inch. It will be seen that projections on the movable and stationary die faces seat against each other to form a core for producing the rectangular hole that extends through the casting near the flange end.

Both core heads consist simply of a hydraulic cylinder with a piston to which the core is attached. Water under pressure is admitted into the cylinder while the dies are closing, to position the cores for the casting operation, and after the dies have opened, to release the die-casting from the movable die. Five ejector-pins on the movable die force the casting from the die after the cores have been withdrawn.

While these hydraulic core-pulling heads are mounted at the top and bottom of the die shown, they could also be located for moving cores at an angle. They could not, however, be positioned horizontally, because the large-diameter bars which run from end to end of the Polak die-casting machines would interfere with such a location.

The fitting shown at *B* in Fig. 1 is made with a cored hole that runs at right angles to another cored hole extending the length of the casting. Each of these cored holes is of two diameters. The hole that extends through the entire piece was produced by a hydraulic core-pulling head mounted on top of the die, while the other hole, located at right angles to the one first mentioned, was formed by a core fixed to the stationary die.

Dies Designed to Produce Two Complicated Castings at One Time

The dies shown in Fig. 5 are of considerable interest because of the fact that they produce two pieces of complicated shape at one time. The casting, which is shown at *C*, Fig. 1, is part of an ice-cream dipper, and the bowl-shaped end is cast to a knife-edge against which a mounted chromium-plated bowl is seated. Two hydraulic core-pullers are required for this die, the upper one moving a core which forms the cavity at the bowl-shaped end. The lower core-puller does not produce any holes, but is necessary because of the peculiar shape of the end opposite the bowl. These dies were photographed lying horizontally on the bench, but they are mounted in the die-casting machine with the core-pulling heads vertical.

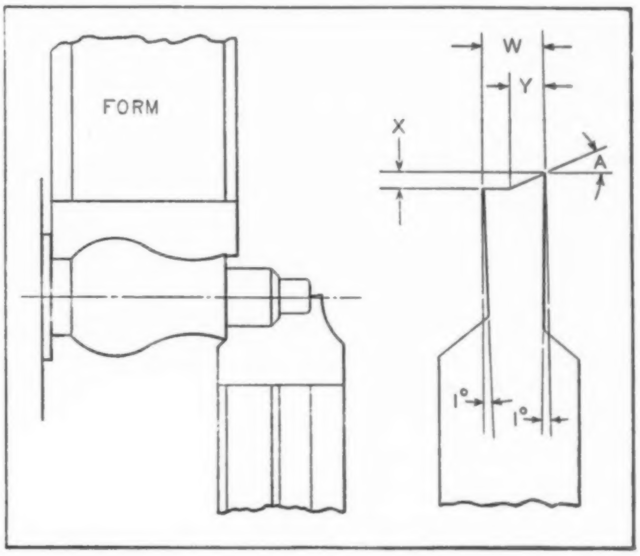
In designing dies for brass castings, it should be remembered that the castings contract in cooling about the same amount as brass forgings, which is generally considered 0.010 inch per inch of length or diameter. Holes smaller than 3/16 inch in diameter should not be cored, as cores of small diameters will not stand up under the high temperatures of brass die-casting. They will soon heat-check badly and crack off.

Although only hydraulically operated and fixed cores have been described in this article, dies have been constructed by this concern with cores operated through rack-and-pinion mechanisms. These mechanisms are actuated by coming in contact with bars mounted on the machine, when the movable die is opened and closed.

Designing Cams for Automatic Screw Machines

Procedure Outlined in a Set of Instructions that have been Used Successfully in Training Tool Designers for Automatic Screw Machine Work—First of Two Articles

By I. A. SWIDLO, Ordnance Engineer
Springfield, Mass.



Diagrams Showing Cutting-off Tools and Forming Tool for Screw Machine Work

SINCE a battery of automatic screw machines requires the investment of considerable capital, it is very important that such equipment be employed as efficiently as possible. Thousands of different parts are produced on automatic screw machines at production rates as high as 3/4 second per piece. To obtain these high rates, however, it is necessary to have the idle and cutting periods of the various tools overlap as much as possible.

The saving of a few seconds on each part, multiplied by thousands of parts, often results in a tremendous reduction in manufacturing costs. Hence the operation lay-outs and the selection of tools must be done by the most experienced tool engineer available. It is poor economy to invest in modern, high-priced machines and then use antiquated methods and poorly laid-out cams and tooling.

In this article, the important factors to be considered in designing cams for Brown & Sharpe machines are brought out and systematic instructions are presented, which have been found helpful in training draftsmen to design efficient cams and tools.

Determining upon the Machining Methods

The first step in equipping an automatic screw machine for the production of a given piece is to decide what kind of tools should be used and how they should be arranged to give the quickest and best results. This requires careful consideration, especially with respect to the sequence of operations.

Care should be taken not to use turret tools for forming when cross-slide tools can be used to better advantage. The various operations should be overlapped; that is, drilling and forming operations, for example, should be so arranged that they can be performed simultaneously. Cutting-off may also be done while forming. A part such as shown in the view to the left in the illustration, can be "chucked-out" and cut-off by a combination forming and cutting-off tool. Of course, standard tools should be used whenever possible to obtain a simple set-up and to keep the tool cost down.

The cutting speed depends primarily on the material used for the tools

Table 1. Cutting Speeds Recommended for Automatic Screw Machines

Name of Tool	Speed, in Surface Feet per Minute				
	Brass	Soft Machine Steel, 0.10-0.20 Per Cent Carbon		Tool Steel, 0.80-1.00 Per Cent Carbon	
		Carbon Tools	H.S.S. Tools	Carbon Tools	H.S.S. Tools
Forming Tools	Use Maximum Spindle Speed Available on Machine	80	130	50	80
Cut-off Tools		80	130	50	80
Hollow-mills		70	120	40	65
Balance Turning Tools		70	120	40	65
Box-tools, Roughing		60	85	40	60
Finishing		75	130	40	60
Center Drills		60	85	30	45
Drills		50	70	35	50
Dies		30	50	15	25
Taps		25	35	12	20
Reamers		80	115	40	60
Counterbores		70	100	35	50
Boring Tools		60	85	30	45

and the material to be machined. The condition of the machine should also be considered. It is good general practice to use the highest spindle speeds that the tools will stand.

Table 1 shows approximate cutting speeds which may be used as the basis for calculating the proper speed for any given job. Each job should be given individual consideration.

The spindle speed, in revolutions per minute, is found by the formula,

$$N = 3.82 \frac{S}{D}$$

in which,

N = revolutions per minute;
S = surface speed in feet per minute; and
D = diameter of stock.

The spindle speed nearest that obtained by this formula should be used.

The throw or rise of the cam lobe required for each of the various kinds of tools employed, is con-

Table 2. Feed per Revolution for Different Types and Sizes of Tools

Circular Forming Tools

Width of Tool, Inches	Feed per Revolution of Spindle, Inches: Brass	Machine Steel	Tool Steel	Width of Tool, Inches	Feed per Revolution of Spindle, Inches: Brass	Machine Steel	Tool Steel
1/8 to 1/4	0.002	0.001	0.0005	17/32 to 3/4	0.0012	0.0006	0.0003
	0.001	0.0005	0.0002		0.0006	0.0003	......
9/32 to 1/2	0.0015	0.0008	0.0004	25/32 to 1	0.001	0.0006	......
	0.0008	0.0004	0.0002		0.0006	0.0003	0.0001

Circular Cut-off Tools

0.060	0.001	0.0008	0.0005	0.160	0.002	0.0015	0.001
0.080	0.001	0.0008	0.0005	0.180	0.002	0.0015	0.001
0.090	0.001	0.0008	0.0005	.....	.....	......	.....
0.125	0.001	0.0008	0.0005	.....	.....	......	.....

Hollow-Mills

Feed per revolution for roughing cut, 0.010 to 0.006
Feed per revolution for finishing cut, 0.015 to 0.010
Maximum depth of cut for finishing, 0.015
Minimum depth of cut for finishing, 0.004

Box-Tools

Feed per revolution for roughing cut, 0.009 to 0.003
Feed per revolution for finishing cut, 0.012 to 0.010
Depth of cut for finishing, 0.007 to 0.004

Centering Drills*

Diameter of Drill, Inches	Feed per Revolution, Inches: Brass	Machine Steel	Tool Steel
1/4	0.004	0.003	0.002
5/16	0.004	0.004	0.003
3/8	0.005	0.0045	0.004
1/2	0.0055	0.005	0.0045
3/4	0.006	0.0055	0.005
1	0.0065	0.006	0.0055

*Always allow dwell of 5 to 8 revolutions at end of cut.

Drills

Diameter of Drill, Inches	Feed per Revolution, Inches: Brass	Machine Steel	Tool Steel	Diameter of Drill, Inches	Feed per Revolution, Inches: Brass	Machine Steel	Tool Steel
1/16 to 3/16	0.002	0.002	0.001	5/16 to 1/2	0.012	0.005	0.003
	0.010	0.0035	0.002	1/2 to 11/16	0.014	0.006	0.0035
3/16 to 5/16	0.010	0.0035	0.002	11/16 to 7/8	0.015	0.007	0.004
	0.012	0.0045	0.003	1	0.016	0.008	0.004
				....	.....	.....	.....

Reamers*

Diameter of Reamer, Inches	Feed per Revolution, Inches	Material Left for Removal by Reamer
1/8 to 3/16	0.005	0.005
1/4 to 1/2	0.007 to 0.010	0.006 to 0.008
9/16 to 3/4	0.010 to 0.014	0.008 to 0.010
13/16 to 1	0.016	0.010

*Reamers should be used with floating holders.

Boring Tools

Feed per revolution, from 0.003 to 0.006 inch
Depth of cut, 0.005 inch

Knurling Tools

The feed per revolution for a turret knurling tool is from 0.010 to 0.025 inch when feeding on, and from 0.025 to 0.040 inch when feeding off.
The feed per revolution for a knurling swing tool is from 0.002 to 0.006 inch.

Feed, in Inches, per Revolution for Counterbores

Diameter of Counterbore	Width of Cutting Edge, Inches: 1/16	1/8	3/16	1/4	Diameter of Counterbore	Width of Cutting Edge, Inches: 1/16	1/8	3/16	1/4
3/16	0.0025	......	......	......	5/8	0.005	0.0048	0.0038	0.0030
1/4	0.0028	0.003	......	......	11/16	.....	0.005	0.0040	0.0030
5/16	0.003	0.0033	0.0025	......	3/4	.....	0.0055	0.0043	0.0032
3/8	0.0035	0.0037	0.0028	0.0025	13/16	.....	0.0058	0.0045	0.0035
7/16	0.0035	0.004	0.003	0.0025	7/8	.....	0.006	0.0048	0.0038
1/2	0.004	0.0042	0.0032	0.0028	15/16	.....	......	0.005	0.0040
9/16	0.0045	0.0045	0.0035	0.0028	1	.....	......	......	0.0045

sidered under a separate heading in the following paragraphs:

Forming Tool—To the actual distance the forming tool has to cut, add 0.005 to 0.007 inch for the "approach" movement. The actual distance the tool cuts is equal to the difference between the diameter of the stock and the smallest finished diameter on the part divided by 2; that is, if D is the diameter of the stock and d is the smallest finished diameter, the cam throw T is found by the formula,

$$T = \frac{D - d}{2} + 0.005 \text{ inch}$$

If the forming tool is required to perform a facing operation, the throw should be calculated in accordance with the distance to be faced.

Cut-off Tool—The actual distance the cut-off tool has to cut is equal to one-half the diameter of the stock plus an allowance of 0.005 inch for approaching the stock and an additional 0.005 inch to permit the point of the tool nearest the chuck, or the heel of the tool, to pass the center of the bar stock. This provides for a shaving cut on the end of the bar before it is advanced to permit machining the next piece. If D = diameter of stock and T = cam rise or throw, we have,

$$T = \frac{D}{2} + 0.01 + X$$

The height X (see illustration) may be calculated when Y and angle A are known. The following tabulation gives Y, as well as the total width W, for machines of different sizes. Angle A, for cutting brass, aluminum, and copper should be 25 degrees; for steel, iron, and nickel, 15 degrees.

Machine No.	00–00G	0–0G	2–2G	4	6
W, inches	0.06	0.08	0.09	0.126–0.150	0.150–0.180
Y, inches	0.06	0.04	0.045	0.060	0.060

If the finished part is hollow, the throw T, or actual distance the cut-off tool has to cut, is found by the formula,

$$T = \frac{D - d}{2} + 0.01 + X$$

in which d is the diameter of the hole.

In calculating the throw for the cutting-off tool, use the outside diameter of the stock, irrespective of the groove that may be produced by the forming tool. It is desirable to use a coarse feed for the cutting-off tool while it travels in the groove, before it begins to cut. This procedure will save time.

Hollow-Mills, Balance Turning Tools, and Box-Tools—It is not advisable to use a box-tool for roughing operations. A hollow-mill or balance turning tool should be used for rough-turning. The cam rise or throw for these tools equals the length to be turned plus an allowance of 0.010 inch to permit the tools to approach the stock at a nominal feed without causing them to knock at the beginning of the cut.

It is customary to leave 0.010 inch on a shoulder that is to be faced with a forming tool. To facilitate starting a hollow-mill on the end of square stock, a cut-off tool on the cross-slide or a facing and centering tool mounted in the turret should be used to bevel or chamfer the end of the work to a diameter slightly smaller than the hole in the hollow-mill. If a turret tool is used, the lead cam layout must provide for its operation.

Center Drills—A centering operation always precedes the drilling of a hole on an automatic screw machine. The included angle of the cutting edges of the center drill should be less than the angle of the drill, and it is recommended that this angle be 90 degrees for brass and 100 degrees for steel. The center hole should be made a few hundredths inch larger than the drilled hole to avoid a sharp-edged hole, from one to two hundredths on a side being sufficient.

The throw T, or distance the centering tool must travel for centering operations on *brass* when the point has an included angle of 90 degrees, is found by the formula,

$$T = \left(\frac{D}{2} + 0.01\right)$$

in which,

D = diameter of drilled hole; and

T = throw or cam rise.

In centering *steel* with a tool having an included angle of 100 degrees, the throw is found by the formula,

$$T = \left(\frac{D}{2} + 0.01\right) \times 0.839$$

Drills—In calculating the cam throw for a drilling operation, it is necessary to consider the depth of the center made by the centering tool, the length of the drill point, and the length of the drilled hole plus the thickness of the cut-off tool if the hole goes completely through the part. If the depth of the hole is more than 2 1/2 times the diameter, two or more drills should be used. If a sufficient number of positions are not available on the turret to permit using more than one drill, the cam should be designed to feed the drill in to a certain depth, withdraw it to permit cooling, lubricating, and clearing of chips, and then advance the drill again, repeating this operation at intervals until the hole is drilled to the required depth. For automatic screw machine drilling, the author recommends a 118-degree drill point. The length of the point on a drill ground to this angle is equal to $D \div 2 \times$ tan 31 degrees.

The cam throw T for a drilling operation preceded by centering equals $L + W$, where

L = length of hole; and

W = thickness of cut-off tool.

For a drilling operation without a preliminary centering of the work,

$$T = L + W + \frac{D}{2} \tan 31 \text{ degrees}$$
$$= L + W + 0.300\, D$$

Threading—In threading, two operations are necessary, the forward movement of the tap or die in cutting the thread and the return movement of the tool. In calculating the rise of the thread lobe or throw of the cam, assume that

T = throw of cam for forward threading movement of tap or die;
n = threads per inch;
L = length of thread; and
R = number of revolutions required for forward threading movement;
= $L \times n$ + extra turns required for clearance.

Then,

$$T = \frac{R}{n} - 0.005 \times R$$

for screw where R = 30 to 15

$$T = \frac{R}{n} - 0.007 \times R$$

for screw where R = 15 to 8

$$T = \frac{R}{n} - 0.01 \times R$$

for screw where R = 8 and less

The reason for reducing the rise of the cam lobe is to allow the holder to lag behind the die or tap, in order to avoid the possibility of the tool crowding or being pushed on the screw being cut. It is the best practice to allow the die or tap to lead itself. Provision must be made, of course, for reversing the spindle to accomplish the withdrawal of the tap or die. For the die withdrawal movement, the die-holder must have an additional lag of approximately 10 per cent, because it gains that much over the movement of the die during the time the spindle remains stationary before it is reversed.

In the second installment, to be published in a coming number of MACHINERY, the subject will be continued. The next installment will deal with determining the feed per revolution for each tool and calculating the number of revolutions necessary for each cutting operation; finding the total number of actual working revolutions required to make one piece; finding the time, in seconds, for making one piece; and other calculations required for the design of the cam.

* * *

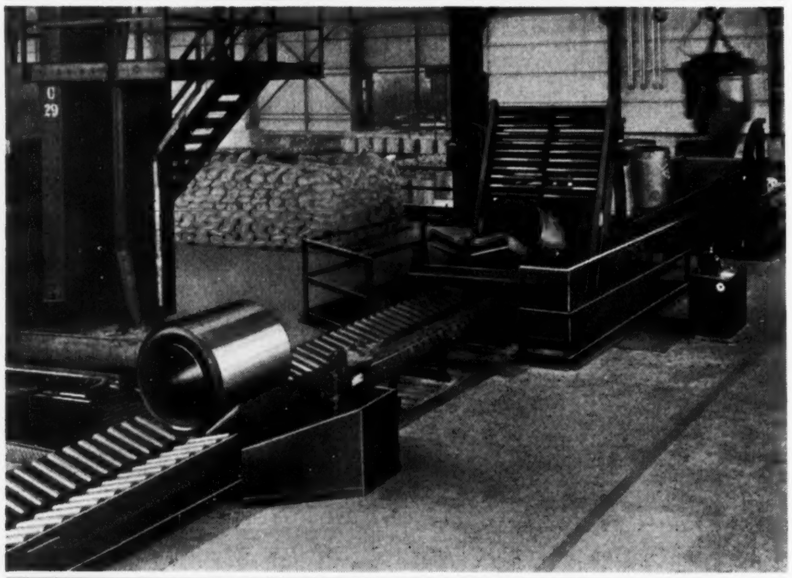
Conveyor Line with Coil "Up-Ending" Device

In handling coiled strips of steel, it is sometimes necessary to turn the coils from a horizontal into a vertical position, or vice versa, as they move along conveyor lines. For this purpose, the Matthews Conveyor Co., Ellwood City, Pa., builds "up-ending" devices of various sizes. One of these "up-enders" is shown in the illustration at the left-hand end of a gravity-roller table to which the coils are delivered by an overhead crane.

The coils move by gravity along this table until they reach the "up-ender," a stop preventing more than one coil rolling on the device at a time when the latter is horizontal. The "up-ender" is operated by moving a switch on the control box seen at the right. It delivers each coil on its side to a trough type roller conveyor which is seen leading to the left.

At the tilting mechanism in the foreground, brakes beneath the conveyor rollers may be used to stop the coils, which may then be turned 90 degrees by the tilting mechanism and discharged on a conveyor that extends at right angles to the trough conveyor. Three tilting mechanisms are provided along the trough conveyor, so that the coils can be discharged on any of three conveyor spur lines, as desired.

An "up-ending" device recently built by this concern has a capacity for handling coils weighing 20,000 pounds. These coils are over 6 feet wide and about 4 feet in diameter. The "up-ender" is 15 feet high.



Equipment for Turning Coils of Strip Stock on End as They Move along a Conveyor Line

* * *

The first typewriter that actually would write and was truly practical was invented by Christopher Latham Sholes in 1867. Mr. Sholes also coined the word "typewriter." This machine was later manufactured by Remington & Sons, the predecessors of the Remington Typewriter Co., a concern that has ever since been prominently identified with typewriter manufacture.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Stock-Feeding Mechanism with Four-Direction Movement

By F. H. MAYOH

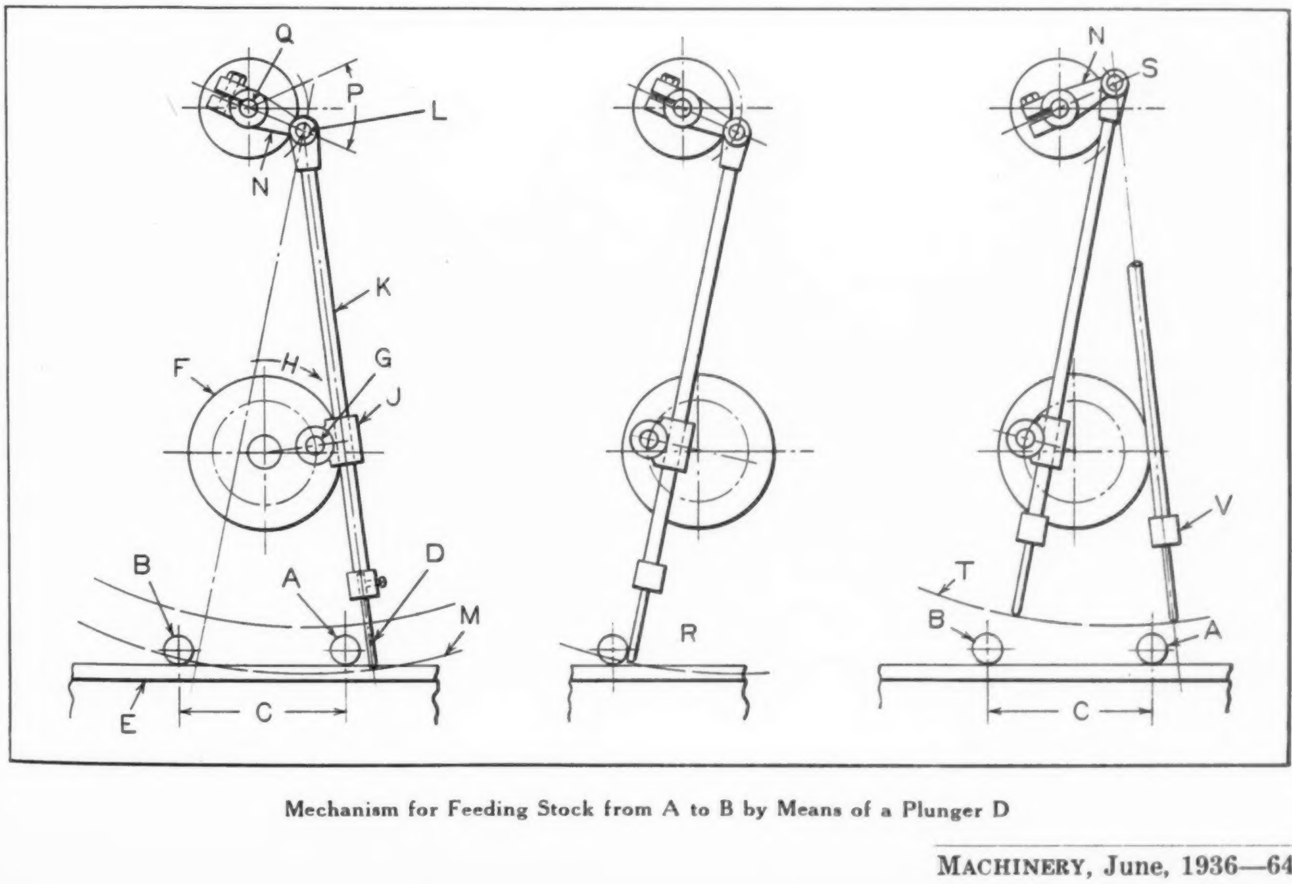
The purpose of the mechanism here illustrated is to feed the round bar *A* in a straight line to the position *B*, a distance represented by *C*. To do this, the feeding plunger *D* must assume the position shown at the left and push the work along plate *E* until it reaches the point *B*. Plunger *D* must then rise and swing back over the top of the succeeding bar at *A* and drop to its original position.

The disk *F* with the crankpin *G* revolves continuously in the direction indicated by arrow *H*, carrying the connecting yoke *J* along with it. Yoke *J*, being free to travel up and down the rod *K*, causes plunger *D* to push the bar *A* along the plate *E*. As rod *K* is pivoted at *L*, the movement of the end of plunger *D* is along arc *M*. Lever *N* rocks through the arc *P* about the operating shaft *Q* as a center.

Starting with the mechanism in the position shown in the view to the extreme left, the revolving disk *F* carries yoke *J* along until the work assumes the position shown in the central view at *R*. At this position, arm *N* rises until the mechanism is in the position shown in the view to the right, where the center of lever *N* coincides with the line *S* and the end of the plunger is on the arc *T*.

Continued rotation of disk *F* carries the plunger rod back to the position *V*, while lever *N* is free to swing downward to the original position shown in the view to the left. Plunger *D* is now ready to push another bar along plate *E* from *A* to *B*.

The illustration shows plunger *D* as having traversed along the circular paths of arcs *M* and *T* with its upward and downward movements at the ends of the stroke, but in actual practice, due to the timing of the machine, the plunger follows a more irregular course. The object of the entire movement is simply to push one bar over into place and then to clear the oncoming bar when the plunger travels back to the starting position.



Mechanism for Feeding Stock from A to B by Means of a Plunger D

Double-Action Cam that Moves Transfer Arm in Three Planes

By JOSEPH E. FENNO

One of the most interesting mechanisms that the writer has had the opportunity to describe is used in a four-slide spring-winding machine. Springs 1/2 inch in diameter and 1 1/4 inches long are made in this machine. At one station, the spring is coiled and cut off. It is then carried, by means of a transfer arm, to another station, where the ends are bent parallel with its axis, after which the completed spring is ejected from the machine. The transfer arm moves through three different planes during each cycle, yet all its actions are controlled by a single cam.

This unusual movement, which is ordinarily accomplished by using a combination of cams, is obtained by the mechanism shown in Fig. 1. The reason for forming the spring ends at a separate station is that another spring is being wound while the preceding one is being formed. With this arrangement, the production is practically double that obtained when the forming was done on the coiling mandrel. As a matter of fact, it would have been extremely difficult to perform all the operations at one station.

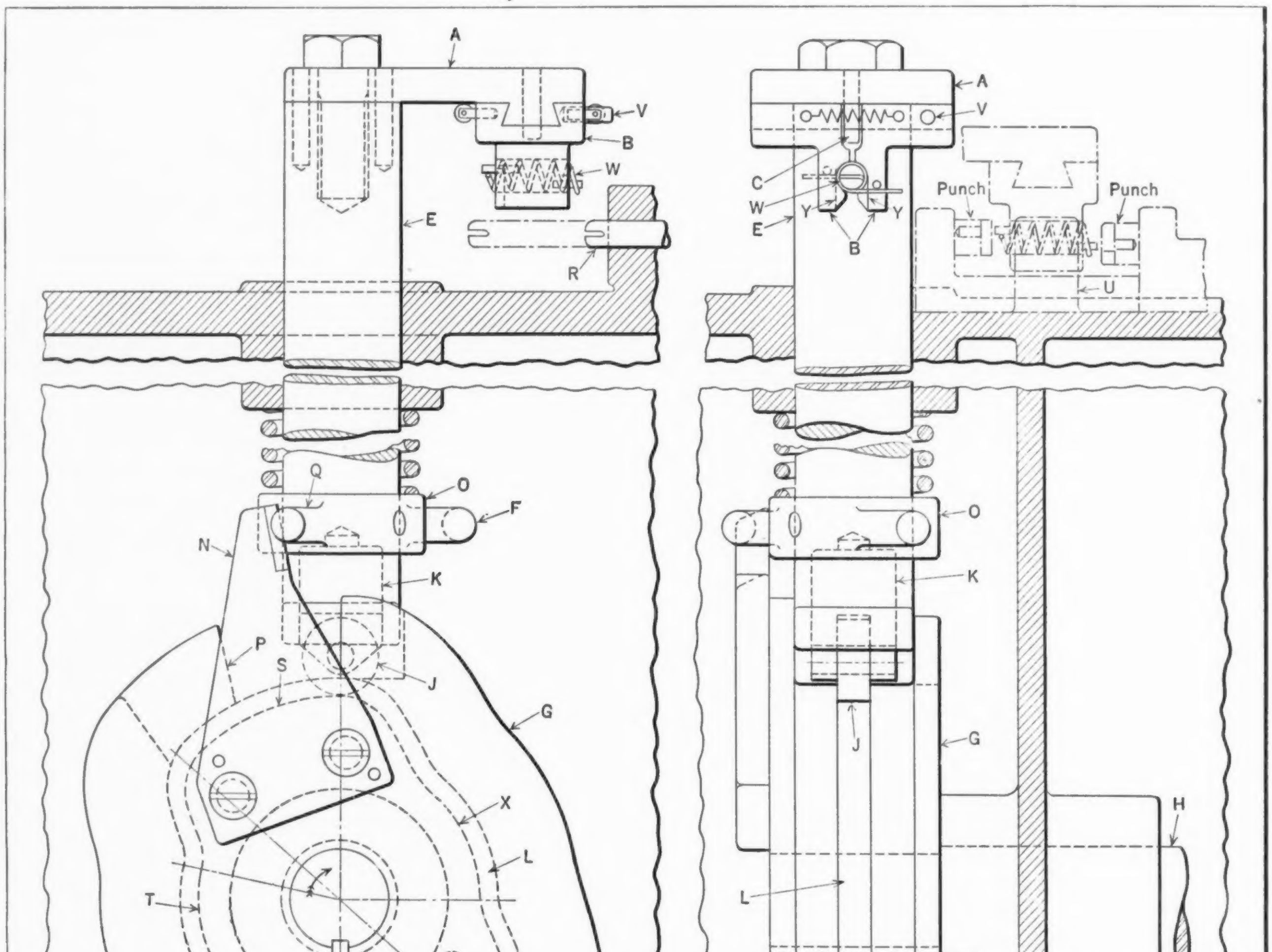


Fig. 1. Cam Mechanism for Operating Transfer Arm of Spring-coiling Machine

Referring to Fig. 1, the transfer arm *A* has two jaws *B* mounted on its overhanging end. Between the jaws is gripped the coil spring *W*, on which the coiling and cutting operations have been performed. The jaws are centralized by the pin *C* against which they are held normally by the coil spring shown. The arm is securely bolted and doweled to the vertical plunger *E*, which is a free fit in a long bearing cast in the machine frame. The plunger is given a combined vertical and rotary movement by means of the cam *G* mounted on the drive shaft *H*.

The connection between the cam and the plunger is made by the roll *J* pivoted in the plug *K*. The plug, in turn, is a free fit in a hole bored in the lower end of the plunger. Thus the plunger can be rotated to any position, yet the roll will remain in the same plane, being constrained by the continuous cam groove *L*. As indicated, jaws *B* have grasped spring *W* and elevated it vertically to the position shown, through the action of cam *G*. Incidentally, the coiling arbor *R* has automatically receded to permit the spring to pass upward. The lower end of plunger *E* is square and is a sliding fit between the flanges of the cam. Thus, when the square end is confined between the flanges, the plunger cannot rotate. However, at certain points in the flanges, gaps are provided to permit rotation of the plunger for swinging the transfer arm 90 degrees to the forming station indicated in dot-and-dash outline near the upper right-hand corner of Fig. 1.

The finger *N* is fastened to the cam for the purpose of rotating the plunger at this time. This finger engages a lug on the collar *O*, pinned to the plunger, and starts the rotation of the plunger. The rotary movement is then picked up and continued as the end *P* of the flange comes in contact with the squared end of the plunger. This action is more clearly illustrated in Fig. 2. Here the cam is rotating in a clockwise direction and the finger *N* is about to swing the plunger in the direction indicated by the arrow.

As the cam continues to rotate, the finger *N* engages lug *Q* and rotates the plunger until the flange end *P* comes in contact with the squared end of the plunger and continues the rotation of the latter until it has completed its 90-degree movement. At this position, the squared end of the plunger enters between the flanges, thus preventing further rotation of the plunger, and in addition, the finger and lug absorb the entire starting torque. The rotary movement of the plunger occurs while the roll is passing over the concentric portion *S* of the cam; hence, the height of the arm remains constant at this time. However, as the cam continues to rotate, the roll descends to the low concentric part of the cam lobe at *T* and dwells, causing the arm also to descend and dwell. In descending, jaws *B* enter between two stationary guides *U* which prevent the jaws from opening during the forming operation. The operation at this station consists of bending

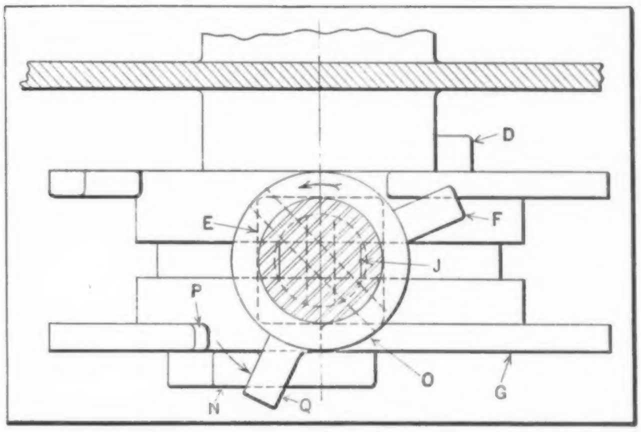


Fig. 2. Plan View of Collar O, Fig. 1, Showing Finger N About to Rotate Plunger E

the projecting ends of the spring outward so that they will be parallel with the axis of the spring. This is done by the automatically controlled punches which advance, with their slides, and bend the ends over the corners *Y* of the jaws. The position of the spring ends relative to the jaws is maintained by the two pins indicated.

When the ends have been formed, the cam raises the arm vertically to its former height. At this time, the roll engages the cam surface at *Z* and, as on the opposite side of the cam, the plunger and arm are brought back to their original position. In this case, however, finger *D*, engaging lug *F*, starts the rotation of the plunger, after which the corresponding flange end completes the 90-degree movement.

When the arm is swung back, a latch (not shown) engages the pin *V* and opens the right-hand jaw, allowing the completed spring to drop into a chute. The cam then allows the arm to dwell until the succeeding spring has been coiled and cut off. Next the roll passes to the cam surface *X*, causing the plunger and arm to descend until the jaws snap over and grip the spring. This completes the cycle.

The heavy coil spring on the plunger insures constant engagement of the roll with the cam. Although this mechanism was designed primarily for a two-station machine, the same principle can be used for three or more stations by merely modifying the cam throws and adding the required fingers and lugs. In order to facilitate the machining of the cam, the cam is made in two sections and fastened together with screws, the parting line coinciding with the side of the roll groove. For the purpose of simplification, this sectional construction is not shown.

* * *

The following pertinent observation is made in *The Houghton Line:* The most tragic failure of civilization is the nation which must build battleships to find work for its people to do.

Automobile Painting is the Last Word in Metal Finishing

When It Comes to Fine Appearance of a Metal Product, the Automobile Manufacturers are in the Lead—The Facilities for Painting the Lincoln - Zephyr Were Planned for Convenience and Efficiency

AUTOMOBILES are sold just as much on appearance as on mechanical details. It is for this reason that automobile manufacturers have developed painting methods to their present high state of perfection. These methods should be of considerable value to the manufacturers of all metal products where saleability depends to any considerable extent upon appearance.

In preparing for the manufacture of the Lincoln-Zephyr, the recent entry of the Lincoln Motor Co. in the medium-price automobile field, a large amount of capital was expended to provide painting facilities that would give maximum convenience, health protection, and efficiency. There are no short cuts in painting if a fine appearance and a finish that will stand up for a long time are to be obtained; therefore, the painting of this automobile involves many details. It takes ten hours for an automobile body or fender to pass through the painting department, even though it moves continuously. The painting practice of the plant mentioned will be described in this article.

As outlined in the article on Lincoln-Zephyr manufacture published in April MACHINERY, the all-steel welded automobile bodies are received unpainted at the Lincoln plant, without trimmings or fenders, from the LeBaron plant of the Briggs Mfg. Co., Detroit, Mich. While the bodies are suspended from an overhead conveyor, the gasoline tank, muffler pipe, gasoline line, and shock absorbers are attached. The bodies are then transferred to an overhead conveyor of the painting line, where they are carefully inspected for defects.

Fenders and a radiator shell to go with each body are suspended on an auxiliary conveyor which moves alongside the main conveyor. The auxiliary conveyor carries the smaller parts through separate bays in the same painting booths and ovens as those through which the bodies pass. The smaller pieces, therefore, are painted with the same paint as the bodies for which they are intended, and they receive the same cleaning and drying treatments.

It will be remembered from the previous article that this automobile is built without the conventional chassis. The body is of a "bridge truss" construction, and the axle assemblies, engine, etc., are attached directly to the body frame.

The work of preparing the bodies for painting consists of a series of steps. Deoxidine cleaner (manufactured by the American Chemical Paint

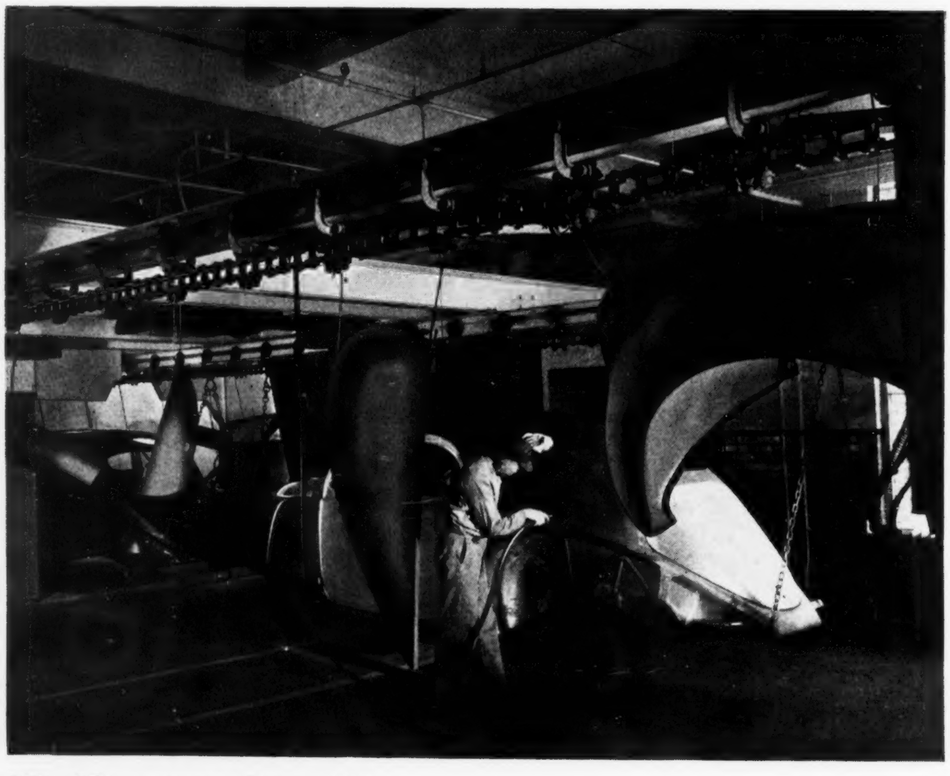


Fig. 1. Cleaning Lincoln - Zephyr Bodies, Fenders and Radiator Shells Preliminary to Painting them in a Long Series of Operations which Requires About Ten Hours

Fig. 2. Air Supplied in the Spray Booths from Overhead Forces Paint Fumes to the Floor, where They are Carried away by Water that Falls into Pans and Drains off

Co., Ambler, Pa.) is first rubbed over the entire body by means of long-handled brushes to remove all rust. Rust spots that cannot be removed in this way are sand-blasted away. Then the cleaner is washed off with water, and steam is applied to hinges and crevices to remove grease, dirt, etc. The body is finally washed with wood alcohol to remove any acids that may still be present. The fenders and radiator shells are given the same treatment as the bodies. In Fig. 1 is shown some of this preliminary work.

At the end of the cleaning, the bodies are dried by passing through a long oven, held at a temperature of 250 degrees F. They are then rubbed down with cloths that have been treated chemically to eliminate lint. A coat of Dux primer, a product of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., is next sprayed on and then three coats of a synthetic surfacer paint, manufactured by the same company, are applied.

All painting operations are performed in booths in which air delivered from above forces the fumes toward the floor away from the faces of the painters. The particles of paint in the fumes are carried from the booths by water which falls into pans at the sides of the booth. In the case of the lacquers used for the final painting, the pigments are reclaimed from this water and used for priming. Fig. 2 shows a general view of one of the paint booths, with the water pans along the floor. An oven is seen in the background.

After the prime coats have been applied, the bodies pass through another oven, about 165 feet long, the temperature of which is 250 degrees F. It takes approximately one hour for the parts to go through this oven at the conveyor speed of three feet a minute. Sandpaper (280-grit) is next used, wet or dry, to smooth the prime coats of paint, after which the bodies are again washed with cold water and carried through a short oven for drying. Another coat of priming is then applied to any spots resulting from the sanding. Pits or other defects are puttied, and spots of this kind are covered with priming, after which the bodies are cleaned once more.

Now the bodies, fenders, and radiator shells pass through a booth 80 feet long (the one shown in Fig. 2) in which they are sprayed with five coats of lacquer. The lacquer is piped to this spray booth from a mixing room in which there are eight tanks for mixing standard colors. Pipes lead directly from these tanks to six stations in the spray booth. At each of these stations there are eight standpipes which enable the operator to obtain immediately any standard color desired. Because each color is delivered from one source, the paint applied to the fenders and body of any one car is sure to be the same, regardless of the station at which it is sprayed. At the end of this painting booth, the bodies enter an oven, the temperature of which is maintained at 190 degrees F., in which they remain approximately one hour.

When the bodies, fenders, and radiator shells leave this oven, they are rubbed down with 280-grit sandpaper, moistened with a lubricant consisting of 10 per cent machine oil and 90 per cent Sunoco emulsifying oil. The bodies and the other parts are then buffed all over by means of sheepskin wheels attached to portable electric tools that are suspended from overhead. A lacquer polishing compound is used. The parts are then finished with a clean sheepskin wheel. After a final spray to eliminate any "off color," the parts pass through another oven maintained at 190 degrees F., about twenty minutes being required for them to pass through this oven. The places where the body was "spot" sprayed are then polished, after which the car is wiped clean all over and given a final inspection.

Engineering News Flashes

The World Over

World's Largest Power Shovel

With a capacity of 50 tons at one scoop, the world's largest power shovel has recently been put into operation by the Northern Illinois Coal Corporation. This new giant was built by the Marion Steam Shovel Co., and its electric drive and control equipment was furnished by the General Electric Co. The outstanding feature of the huge machine is its immense dipper or bucket, which has a capacity of 32 cubic yards, struck measure, or approximately 40 cubic yards heaped up—enough to fill an ordinary room at one scoop. The dipper is, roughly, 10 by 8 by 16 feet in size. In the coal-stripping operations for which it will be used, where the material handled consists of earth, shale, and broken rock, the weight of one dipper load will be approximately 50 tons.

The dipper itself is fabricated from aluminum plates and castings, with an armor of wear-resisting steel at the points where the greatest wear is encountered. The new shovel has a boom over 100 feet long and a dipper handle or stick over 65 feet in length. Material can be picked up at the working level and deposited 70 feet above this level. A mental picture of the operation can be obtained by imagining this shovel picking up a load equivalent to thirty-five medium-sized automobiles at street level and placing them in less than a minute on the sixth or seventh floor of an ordinary office building. The power of all the motors of the shovel exceeds 3500 horsepower.

New Rustproofing Process for Erected Structures

A process for coating steel work in place, which possesses a number of features that appear to be superior to former methods, has recently been introduced by Duraspray, Ltd., London, England. The process, as described in *Engineering*, consists essentially in first applying a priming coat of a special type of red lead paint; then dry-spraying on the wet surface of the priming coat a very finely divided metallic powder, consisting of zinc dust containing a certain proportion of aluminum; and finally applying a finishing coat of paint of a character and color to suit the requirements of the structure. The metallic powder spraying equipment is portable and can be hoisted into any required position. It has a magazine that contains sufficient powder for a day's work.

It is claimed that the process is no more costly than the application of the usual three coats of paint, and that it affords superior protection; also, the coatings can be applied more rapidly, since there is no need to wait for the priming coat to dry. If the finishing coat is sprayed on, it can be applied immediately after the metallic coat has been put on.

Canoes Built from Aluminum

According to *Oxy-Acetylene Tips*, an oxy-acetylene operator recently designed an all-aluminum canoe and constructed it by oxwelding. The hull of the canoe consists of ten strips of aluminum extending from one gunwale to the other, welded together at the seams. The hull is reinforced by several cross-pieces and by suitable reinforcements at the ends and edges. The canoe, which weighs 83 pounds, is permanently leak- and corrosion-proof. The oxy-acetylene welding methods of fabrication made it easy to incorporate air-tight and water-tight tanks, making the canoe non-sinkable.

Working to Music

The Standard Motor Co. of Coventry, England, according to *Industrial Britain*, has introduced a system of broadcasting music to its employes during working hours. The innovation is said to have proved so successful that eventually loud speakers will be installed in all the departments where the noise of the machinery does not make it impossible to hear the music. A program is given for one hour in the morning and one in the afternoon, as well as during the noon hour.

Power of Steam Locomotives Increases

It is of interest to note how the tractive power of steam locomotives has increased within recent years. In 1916, the average tractive power of the 61,000 locomotives in service on American railroads was 33,188 pounds. In 1934, the number of locomotives in service had declined to 48,300, but their average tractive power had increased to

47,712 pounds. It will be noted that the increase in tractive power far outweighed the reduction in number of locomotives, so that there is more actual tractive power available on the railroads today than formerly.

The World's Smallest Brewery

In these news items we frequently refer to the largest type of engineering equipment built. As a contrast, it is of interest to note that the smallest brewery in the world has just been "opened" in England. It covers an area of only 5 square feet; it is less than 8 feet in height, but consists of four complete brewing plants, each capable of producing one gallon of beer per brew. This miniature brewery is installed in one of the departments of the Birmingham University and is used for experiments in connection with brewing research and chemical experiments on hops, barley, and yeast. The brewing conditions of the plant are almost identical with those of any large establishment.

A New Metal-Spraying Process

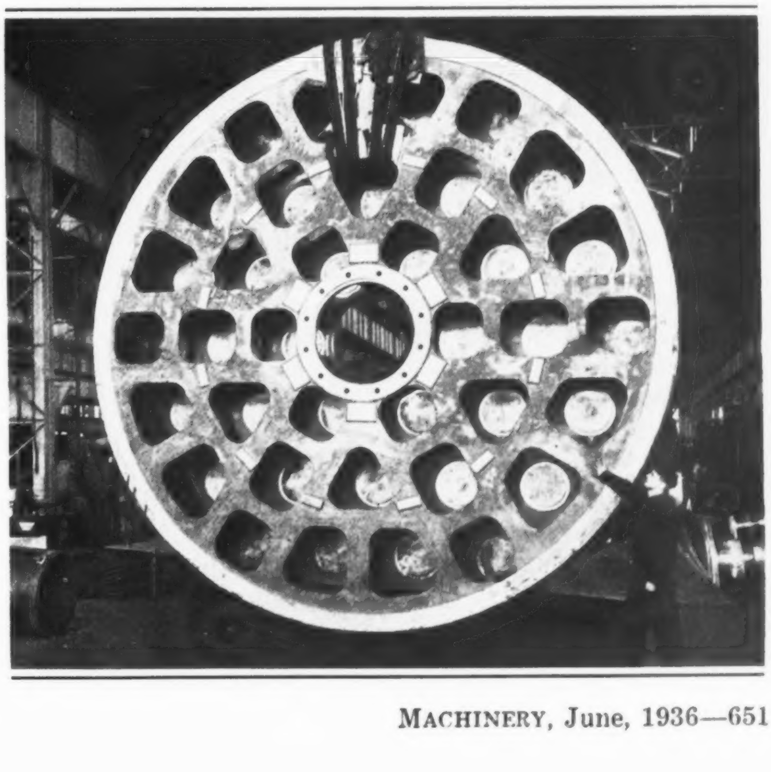
What is claimed to be a new process for depositing, by means of a metal-spraying pistol, protective or decorative coatings of zinc, tin, lead, aluminum, and other alloys on metals, wood, glass, or other surfaces was described recently in *Engineering*. This process, which is known as "Mellozing," has been developed by Mellowes & Co., Ltd., Corporation St., Sheffield, England. The process differs from other metal-spraying processes in that the metal or alloy to be sprayed is first melted in a gas-fired crucible. It is then poured into a container in the pistol and is maintained in a molten condition during the spraying operation by a Bunsen type burner which forms a part of the equipment. The compressed air employed for spraying the metal is preheated. The process is now employed in a number of industries. It is stated that steel window frames, tanks, ladders, automobile wheels, laundry machinery, etc., have been sprayed by this process.

Record-Breaking Activity in Sheffield

According to *Industrial Britain*, the Sheffield steel production is breaking all records. The present output is at the rate of nearly 1,400,000 tons a year, compared with about 1,000,000 tons two years ago, and 800,000 tons five years ago. The bulk of the demand is from the home market and is said to be largely for industrial requirements rather than armaments.

Residences Built by Arc Welding

A large residence now under construction at Ottawa Hills, Ohio, is made with the largest welded-steel frame ever used in a residence. The walls and floors together use a total of 45 tons of steel. The application of arc welding has been so successful that the cost of the completed steel frame was only 2 per cent more than that of a comparable wood frame and floor joists, and its rigidity is much greater. Both shop and field welding were employed, using General Electric arc-welding equipment. The all-welded steel frame, together with 5-inch stone veneer, metal lath and plaster, and air spaces filled with mineral-wool insulation, provides a fireproof home with the minimum of upkeep and elimination of shrinkage.



This 25,000-pound grinding table is used for grinding and polishing the mirror for the new giant telescope being constructed on the West Coast. The grinding table, made of steel plate with welded construction by the Baldwin-Southwark Corporation, Philadelphia, Pa., is over 17 feet in diameter, and with the pan for catching the abrasive material bolted to the face of it, has an over-all diameter of 20 feet, while the depth of the table is over 24 inches

EDITORIAL COMMENT

FEWER working hours and less machinery—and unemployment will be a thing of the past! This is the economic doctrine that is still being preached in this country and that has given the English justification for speaking of us as a nation of "economic illiterates." This fallacious doctrine finds expression not only among those who have suffered directly from the depression, and who may be excused for grasping at any straw that would seem to help them in their trouble; it is also voiced by men in the highest governmental positions, and by the leaders of organized labor.

It is obvious to anyone who applies reason to his economic thinking that shorter hours and less machinery can mean only one thing: Less goods will be produced per worker, so that, with wages remaining the same, prices must rise. This means that more of the week's wage will be required to buy the necessities of life, and less will be left for any of the comforts. A reduced standard of living will be the result.

"Fewer Working Hours and Less Machinery" Solves No Problem

What we need, in order to solve the problem of unemployment, is not less work, less machinery, and less of the products of labor, but a more equitable distribution of the returns of agriculture and industry, so that all who contribute by work of hand or brain may obtain as nearly as possible their due share. This would necessitate, among other things, less government, fewer unproductive officials, and less taxes—for about one-third of everyone's income now goes to meet government expenditures.

The problem of an equitable distribution is not an easy one to solve; it certainly is not one that politicians are capable of solving. But if the problem were attacked as the engineer approaches his problems—with the single purpose of finding the right answer—there is no reason why the minds who have been capable of organizing and developing our great engineering plants would not be able to solve this problem as well.

If the problems of industry and agriculture were thus attacked by reason and common sense, instead of by the emotional appeal of the politician, it would be possible to create such a rise in the standard of living that there would be an increased demand for the products of industry. This, in turn, would cause an increased demand for labor. The population of the country, regularly employed, would constantly consume more and more, not only of the necessities, but also of the comforts, services, and luxuries that would be available. That is the only way in which to solve the unemployment problem.

A Higher Standard of Living Only Can Give Employment to All

At the present time only a comparatively small number of people have such houses, food, clothing, and other benefits as our civilization is capable of furnishing; but to provide for all able and willing to work such a standard of living as is now enjoyed by the comparatively few, requires not shorter hours and less machinery, but more and better machinery. We have never produced, even in boom years, enough to provide a reasonable standard of living for the entire population.

There is another problem in connection with unemployment that is almost entirely overlooked. Millions of the unemployed are unskilled. Knowing no trade and having no training for any actual occupation, they are to a large extent "unemployable," even when there is a demand for labor. This has been clearly demonstrated in the machinery industries for some time. In spite of the staggering figures recording the number of unemployed, the machinery industries in most centers are unable to find qualified workers, capable of doing the work that is required.

Millions Can Find No Jobs Because They Have No Trade

Too much of the discussion of the unemployment problem is carried on by people who know little or nothing of industrial requirements—people who do not understand that industry cannot just take any man off the street or the farm and put him to work. They have no appreciation of the fact that it takes longer to train a first-class toolmaker than it does to educate a dentist, and that one of the serious troubles of unemployment is that millions of the unemployed are untrained.

When our problems are tackled as they are at present, they are well nigh unsolvable; but with a little more "economic literacy" in federal, state, and municipal governments, in business circles, and in labor organizations, their solution might become reasonably simple.

Repairing Patented Machines

May or May not the Buyer of a Patented Machine or Device Make His Own Repairs, Rebuild, or Improve the Machine?

By HOWARD S. BRYANT
Patent Attorney, Kansas City, Mo.

WHEN patented machines or devices are involved, it becomes a question of considerable importance to the manufacturer of these machines or devices to know when and when not purchasers may make their own repairs, or rebuild or improve the machines. To what extent may the manufacturer restrain his customers from making repairs and replacements, or from rebuilding machines, in order to avoid buying repair parts or new equipment from him?

The manufacturer who uses a patented machine or device is equally interested in an answer to this question. To what extent can he repair, rebuild, or improve the patented equipment in order that he may use it in the most economical manner?

First, let us consider the fundamental point of the patent law. The owner of a patent has the right to exclude others from the making, selling, or using of his invention during a seventeen-year term. He cannot restrict the use of his invention, however, after he has sold the patented article and it has passed into the possession of the purchaser. After the sale, he has no other rights in this respect than those provided by the general law of contracts, which are the same as those of any other seller of property.

Briefly, as soon as the patented machine or device has been sold in the market, the machine or device is released from the monopoly of the patent laws. The purchaser may resell it at his own price, use it, scrap it, or sell it as junk; he may also prolong its usefulness by ordinary repairs or replacements, but he may *not destroy the identity of the machine or reconstruct it.* When he does this, he infringes upon the patentee's exclusive right of making such machines or devices. Until he reconstructs, however, he may deal with the machine in the same way as he does with any unpatented article; if he attempts reconstruction, he brings the machine back within the confines of the patent monopoly.

The Right of the Purchaser to Repair or Replace Broken Parts

The right of the buyer to repair or replace broken parts is a necessary sequence of his purchase. It is based on his right to the full use of the device that has passed into his ownership. He may repair or have repaired, broken or worn-out parts of any patented machine without trespassing upon the rights of the owner of the patent. This right is not limited merely to restoring defective parts, but extends to replacing them, unless they, themselves, are the subject of a patent.

This interpretation of the law is based upon the fact that use is the prime object of the machine purchased, and to be of use it must be kept in repair. The repair may include replacement of any part which is worn out or rapidly deteriorated in the normal use of the machine, especially so if the part replaced is inexpensive, as compared with the balance of the machine.

Any other manufacturer also has the right to furnish supplies for these repairs. In the Pyle National Co. case, locomotive headlights were being manufactured and sold under the protection of five patents. Small turbines operated by steam from the locomotive boiler were used in connection with the necessary electrical appliances to generate the current for the headlights. The defendant began to manufacture repair parts for filling the orders of railway companies as these parts were needed to repair the broken or worn-out parts of the patented device. Suit was instituted to prevent the supplying of these parts. The Court, in finding for the defendant, based its decision on the ground that since the railways had the right to replace the worn parts of these devices, the defendant had the right to manufacture and sell them to the railways.

Another Court has held that durable parts—that is, parts that in the normal course of use are not consumed or worn out—may be repaired but not replaced, while non-durable ones may be replaced.

Patented Features Must Not be Manufactured under the Guise of Repairs

While anyone is permitted to repair and replace parts of a patented machine or device when necessary, no one may, under the guise of merely furnishing needed repairs or parts, construct or remake a patented device in competition with the owner of the patent. In determining the legal distinction between repair and reconstruction, the test is whether the identity of the structure is preserved by the repairs. If they are so extensive that the result is a new machine or device, the permissible limit has been passed. It is not necessary that the rebuilt machine be identical with the original one; substantial rebuilding may be termed reconstruction rather than repair.

Furthermore, the replacement of a vital or distinctively new part of a patented combination, if the invention depends primarily on such a part, is reconstruction. If a patented part of the machine is remade without the consent of the patent owner, this remaking would be reconstruction of the thing covered by the patent, even though it might be considered a repair when viewed from the standpoint of the machine as a whole.

This is equally true when the separate part is covered by a separate claim in the same patent which contains combination claims for the machine as a whole. Each claim is a distinct inventive entity, and in the eyes of the law, a patent in itself. An illustrative case may make this clear. In a carbon-coating machine, the part that deposited the coating was known as an equalizing bar and consisted of a circular metal rod having a fine wire wrapped around it. Since this element was the part of the mechanism that would wear out, the user claimed that he was within his rights in rewinding the bar to prolong the life of the machine; but since the patent contained claims covering the bar element alone, the Court decided in favor of the patentee.

Direct and Contributory Infringement in Supplying Parts for Patented Mechanisms

The difference between supplying parts covered by separate claims and supplying parts covered by combination claims is that the first constitutes direct and the second contributory infringement. In the former case, the intent of a person to "pirate" a part covered by a separate claim or patent is immaterial, while in the latter, the intent in furnishing parts covered by combination claims has a bearing on whether there is an infringement.

In direct infringement, it does not matter whether or not the infringer knows that the article is patented, for the patent is a general notice to the effect that the article is protected. When parts of an invention are protected by combination claims and such parts are made, sold, or used, an intent to infringe must be proved. The direct infringer makes or substantially reproduces the whole patented invention; the contributory infringer only makes or sells part of the patented invention.

May a User Improve a Patented Machine?

But what if the reconstructed machine is better than the original? Does it make any difference that the new structure is an improvement over the original patented one? The law says that the infringer cannot justify himself in this way, nor can he contend that it is too difficult or too expensive to repair a defective part and that the improvement was, therefore, justified. Nor can the user of the patented machine justify himself by the statement that the owner of the patent, who has the right to make and sell any part of the patented device, takes advantage of the situation, by assembling parts for his combination and selling them as repair units in substitution or replacement of worn or defective parts. Not even when the owner of the patent subsequently withdraws from the market is the user, or any other person, justified in manufacturing or marketing assembled units or parts representing the invention.

Would a Change in Trade Conditions Justify an Alteration of a Patented Machine?

To what extent will a change in trade conditions justify an alteration that changes the identity of an invention? In the following case [22 (2nd) F 531], the patentee made and sold candy-wrapping machines, of which the essential elements were a cutting table and a wrapping wheel. The machine was adapted to wrap 200 caramels a minute, which was more than double the output of any prior machine. It proved so successful that it became a necessity in manufacturing certain lines of candy.

The machine was adapted to wrap caramels 1 by 1 by 3/8 inch, which sold three for one cent. After the user had manufactured and sold candy for some years, it was found that the market for this size was being undermined by competition with a larger size, 1 1/4 by 1 by 3/8 inch, selling two for one cent. Consequently, the user applied to the owner of the patent to furnish the parts necessary to change the machine into one adapted to wrap caramels of a larger size. This the owner of the patent refused to do, and the candy manufacturer had the work done by a machinist.

The first Circuit Court of Appeals in decreeing for the complainant patent-owner said: "The patentee has no interest in the reason for the change, whether it be due to a wearing out of the machine or to a desire on the purchaser's part for a different machine. The prohibition applies to the machine itself, and not to the state of the purchaser's mind in ordering the change."

It is obvious from the foregoing that the courts have attempted fairly accurately to delineate the boundaries of what is repair and what is reconstruction; but it is not always easy to indicate the line of demarkation between the two in advance, as its determination depends upon the facts with reference to the scope of the invention.

* * *

Another Successful Suggestion System

Employes of the General Electric Co. were paid $35,360 in 1935 for new ideas submitted under the suggestion system. This was an increase of $6142 over 1934. Approximately one-third of all suggestions submitted during the year were adopted. The number submitted was 15,945, compared with 11,438 in 1934; and the number adopted was 5514, compared with 3736 in 1934. Since 1926, when the suggestion system was introduced, more than $500,000 has been paid to the employes for new ideas submitted through the suggestion system.

Accurate Timing Has Greatly Increased the Scope of Spot-Welding

By Controlling the Actual Welding Time to Between One-Sixtieth and One-Thirtieth of a Second, Spot-Welds of Dependable Strength can be Made on a Variety of Metals without Marring the Surface

By DR. PAUL G. WEILLER, Vice-President
The Welding Timer Corporation, Newark, N. J.

RAPID advances in the spot-welding process have been made with the increasing use of corrosion-resisting metals, such as stainless steel, aluminum, and Monel metal. Until a few years ago, spot-welding was considered a rough and inexpensive means of fabricating sheet-metal objects from steel and nickel. Little attention was paid to obtaining welds of uniform strength or to preserving the appearance of the surface.

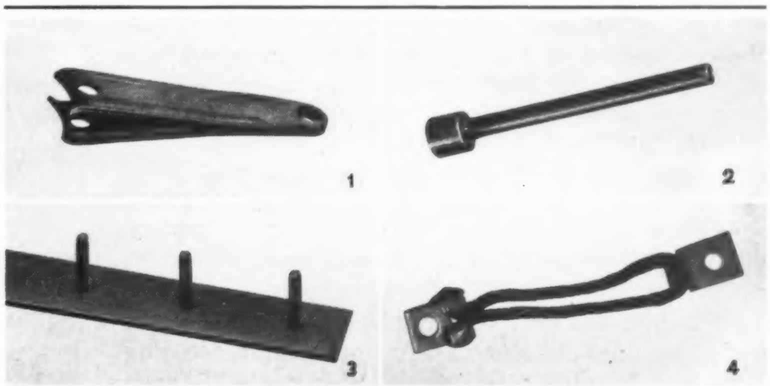
Four Important Factors in Spot-Welding

When stainless steel and aluminum were adopted for structures in which strength was an important requirement, such as streamline trains and airplanes, spot-welding was recognized as the most economical means of fabrication, provided dependable welds of the required strength could be obtained without the surface of the metals being marred. A study of spot-welding methods brought out the fact that there are four important variables in spot-welding, including power, pressure, time, and the electrodes. It was evident that the power could be easily controlled by using a transformer; that the pressure could be regulated by means of a spring, pneumatic cylinder, or other device; and that electrodes of the proper size, shape, and composition could be obtained to suit the various types of metals to be welded. Little attention had been given, however, to the time factor, the timing of an operation having previously been left to the discretion of a more or less skilled operator or else regulated by a relatively inaccurate mechanical device.

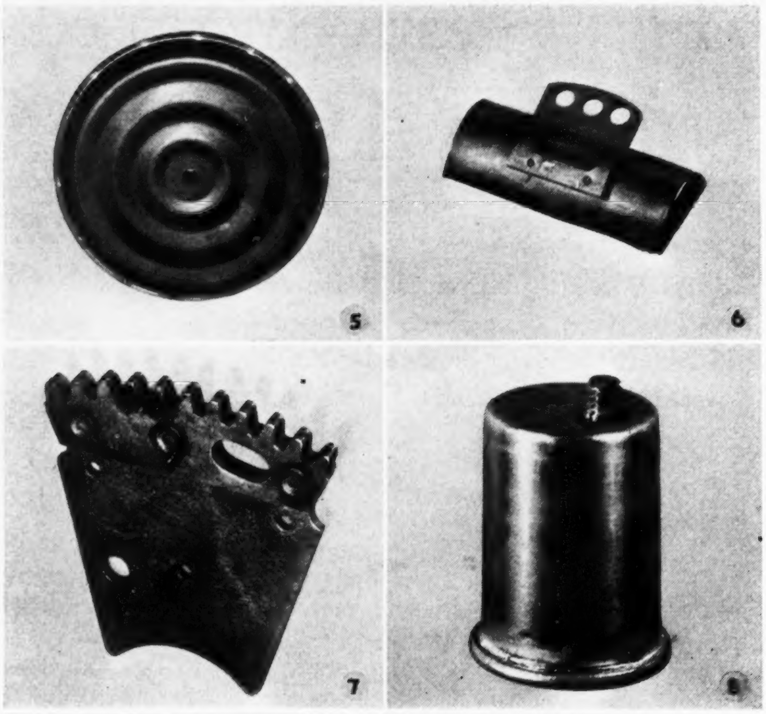
It was soon discovered that marring of the surface could be eliminated if the welding current were passed so rapidly through the work that the heat was dissipated before it reached the surface. This entails extremely short welding periods—usually below three cycles, and preferably between one and two cycles. In terms of sixty-cycle alternating current, this means a welding time between one-sixtieth and one-thirtieth of a second. With accurate control of the welding time, it is possible to obtain welds of uniform strength in thousands of successive operations.

Various types of devices have been developed for the accurate control of welding time, ranging from synchronous motor-driven cams and air-operated dashpots to more or less intricate electronic circuits.

Since only a fraction of a second is required to make a weld after the work is in place, increased rates of production are an additional advantage obtained by the use of timers. It is necessary, however, to permit a certain amount of time to elapse



Spot-welding Operations Made Practical through the Use of Timers: (1) Two Pieces of Spring Steel Welded together to Make a Finger-nail Clipper. (2) Spark Plug Part which Consists of a Nichrome Head Welded to a Steel Stem. (3) Threaded Steel Studs Welded to a Strip of Stainless Steel. (4) Flexible Copper Cable Welded to Tinned Lugs



Additional Examples of Work that can be Produced Satisfactorily when Spot-welding Operations are Controlled by Timers: (5) Two Extremely Thin Sheets of Beryllium Copper Welded together to Make an Instrument Diaphragm. (6) Steel Bracket Welded to Copper. (7) Two Gear Segments of Steel Welded together. (8) German Silver Cup with Brass Stud Welded to the Closed End

between welds, so that the metal will solidify. This is not so much of a problem in ordinary spot-welding as in continuous spot- or seam-welding. It is easy to make as many as 8000 welds in an eight-hour shift. The use of timers permits accurate production planning, especially when the welding operators are paid on a piece-work basis.

By using timers to control spot-welding operations, the human element is entirely eliminated and therefore unskilled help can be utilized. A large clock manufacturer and many radio tube manufacturers employ girls for all spot-welding operations, the machines being equipped with weld timers.

Another fairly important saving that results from the use of a timer is the lessening of electrode wear. Since the electrodes are made either of copper or a copper alloy, excess heat burns them away, marring the work and increasing electrode replacement costs. Also, if pointed or domed electrode tips are used, the cross-section of the electrode surface that is in contact with the work increases as the tip wears. If this change in the electrode is not compensated for by adjusting the power, time, or pressure, the weld characteristics will, of course, change, a fact that calls for constant attention to the electrodes. A timer reduces this problem considerably by lessening electrode wear.

Metals Can Now be Spot-Welded that Formerly Could Not be Fabricated by this Process

Certain metals, such as aluminum, brass, copper, and other good conductors of heat, used to be considered outside the field of resistance welding, but timers have made it possible to weld these metals with the same results as are obtained in welding steel, and in some cases, even better results. Platinum is now being easily welded to phosphor-bronze in making relay contacts. Tungsten, tungsten-carbide, silver, and other metals are also now easily welded through the use of accurate timers. Resistance wires of Nichrome and Constantan as small in diameter as 0.004 inch are being welded to platinum wire of similar diameter. This is done without crushing the wires or changing their resistance properties. Silver-alloy watch cases and gold-plated eyeglass frames are being assembled by spot-welding.

One concern welds 3/16-inch steel studs to No. 18 gage brass nameplates, a job that could not be done at all before the installation of a timer. Brass parts are welded after being chromium-plated without marring the plating. Another unusual job now in everyday production is the welding together of beryllium copper sheets. Spot-welding controlled by a timer has been found to eliminate many problems formerly met by makers of enameled ware who had difficulty with uneven weld surfaces.

The installation of a timer is, of course, not the answer to all resistance welding problems. However, a timer removes the human element and makes possible the nearest approach to perfect spot-welds.

* * *

Milling Plymouth Cylinder Blocks Correction

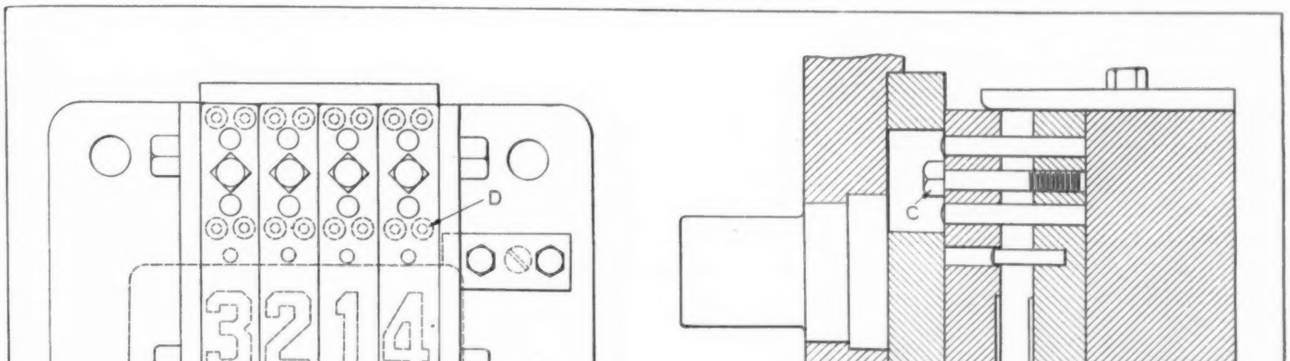
On page 500 of April MACHINERY, where reference was made to the milling of the clutch housing on Plymouth cylinder blocks, the feed should have been given as 24 inches per minute instead of 12 1/2 inches per minute.

Making Automobile License Plates

PRACTICALLY all the automobile license plates in the United States are made in the penal institutions. The methods used differ according to production requirements. Sometimes the simplest equipment is used, so as to provide work for a large group of men. In other instances, quantity production methods are necessary, in order to turn out a large number of license plates within a given time. Typical methods of producing license plates on equipment built by the Toledo Machine & Tool Co. and the E. W. Bliss Co., both of Toledo, Ohio, are described in the following.

The first operation generally consists of producing sheet-metal blanks. This is sometimes done in presses by the use of dies, a method that insures uniform blanks. However, this procedure is rather expensive, owing to the fact that different dies are required for different sizes of blanks; and furthermore, considerable scrap is produced. When the blanks are made with dies, the corners can be rounded at the same time. The holes and slots for attaching the plates to automobiles can also be punched in the same operation through the use of a compound die.

Another method of producing license-plate blanks is to cut large sheets of metal into strips of the correct width for the license plates. The slitting of the large sheets may be done with a squaring shear or a gang slitter, the most economical type of machine depending upon the production. The strips may be fed through the same machine a second time to cut each blank to the correct length. When a squaring shear or a gang slitter is employed, the corners of the blanks must later



Die Set Used in Stamping the Numerals on License Plates for Motorcycles. Dies of the Same General Construction but Larger are Used in Making Automobile License Plates

be rounded and the holes and slots punched in a press.

Still another method of cutting the license-plate blanks to the required length from strips is to use a press equipped with a parting die which also punches four holes and two slots in the blank. After the first stroke of the press, a complete blank is produced at each stroke until the entire strip has been used up. The punching dies are customarily set on each side of the parting-die section, and an adjustable gage is used to regulate the length of the blank.

Stamping the Beading and the Numerals

There are two general methods of forming the beading around the license plates, the letters indicating the state, and the numerals. Either steel dies and punches are used or rubber pads in combination with a steel die. When steel dies are used, it is the practice to stamp the bead and the letters representing the state in one operation, and the numerals in another. A different size of die is required for each length and width of blank; however, fill-in pieces can often be used in dies and punches to adapt them for blanks of various lengths.

The dies used for stamping the numerals are constructed with steel inserts having individual numbers on them which can be quickly changed for succeeding plates. The illustration shows a die designed for stamping the numerals on license plates for motorcycles; the construction for automobile license plates would be the same in principle, but larger.

Top and bottom dies *A* and *B* to correspond with each required number are assembled by means of a bolt *C* for convenient insertion into the die set and for easy removal when a new number is required. The two number dies *A* and *B* are normally kept separated by means of coil springs *D* arranged in four pockets. When the press ram descends after a license plate has been placed between dies *A* and *B*, these dies are pressed together against the action of the springs. When the ram rises again, the springs separate the dies to permit the removal of the stamped license plate.

All numerals are, of course, stamped simultaneously by using the required number of dies. Two identical blanks are often stamped at the same time by the use of two complete sets of dies, so that a pair of license plates for an automobile is produced at each stroke of the press.

When the shaping of the license plates is done by the use of rubber pads instead of punches, it is possible to stamp the beading and the state letters at the same time as the numerals, thus eliminating a separate operation.

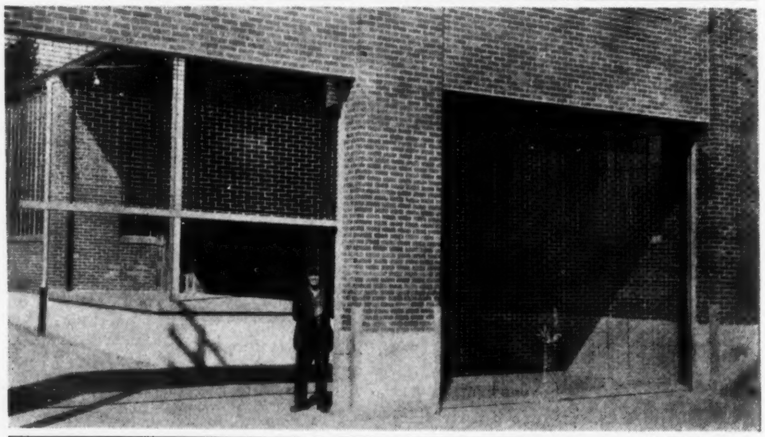
After the press operations on the license plates have been completed, the plates are dipped in paint the color of the background and are then hung on conveyor chains and carried through a drying oven. When thoroughly dried, the license plates are passed through a machine equipped with two rollers, the upper of which is coated with paint of the color desired on the raised numerals, the state letters, and the beading. Another drying operation is performed at the end of the second painting, and the license plates are then ready for distribution.

While the production of license plates only has been described in this article, the same general methods are employed for producing highway markers and other sheet-metal signs used in large quantities by state governments.

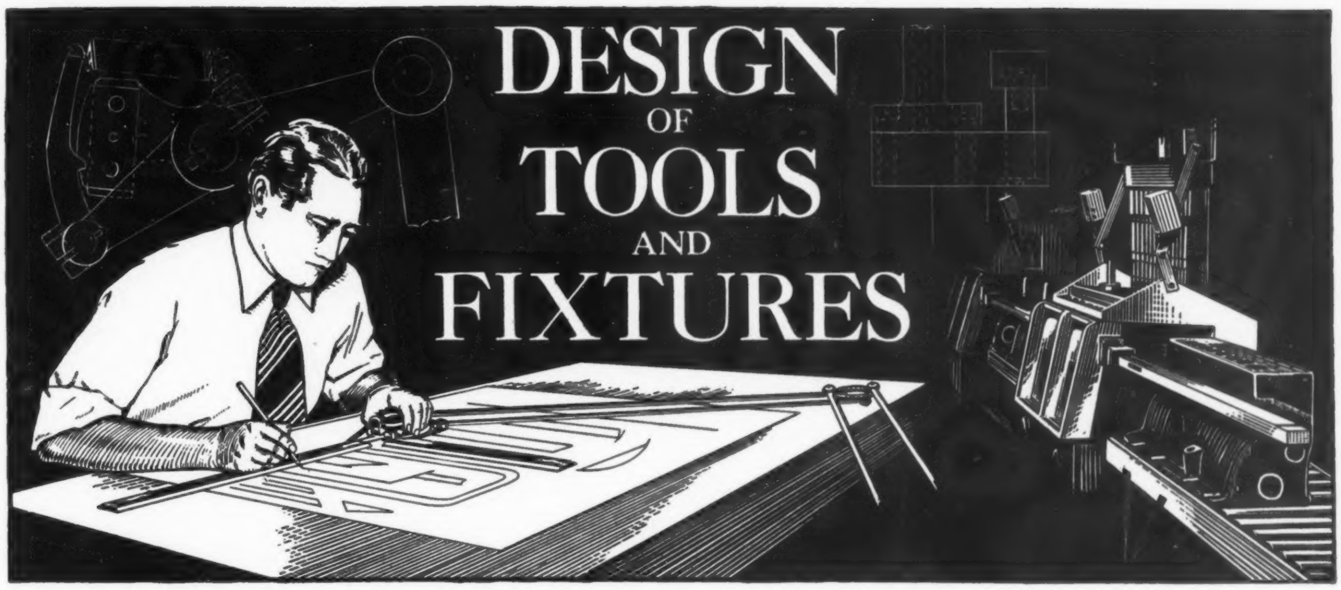
* * *

Exhibitions in 1936

The Exhibitors Advisory Council, Inc., 330 W. 42nd St., New York City, has published a supplement to its publication listing the shows and expositions to be held in the industrial field during 1936. This supplement contains new names not previously listed and expositions listed in the December, 1935, publication, on which there was, at that time, no definite information as to dates and location. The supplement, which consists of ten pages of mimeographed letter-size sheets, is available at $2.



Rolling grilles constructed of various metals are becoming increasingly popular for protecting shop windows or barring doorways. Stainless steel and aluminum make attractive grilles for use around stores, office buildings, etc. The grilles here shown close the entrances to an industrial plant. They are built of hard-drawn galvanized steel bars, malleable iron rings, and cadmium-plated steel tubes. Grilles of these various types are produced by the Cornell Iron Works, Inc., Long Island City, N. Y.



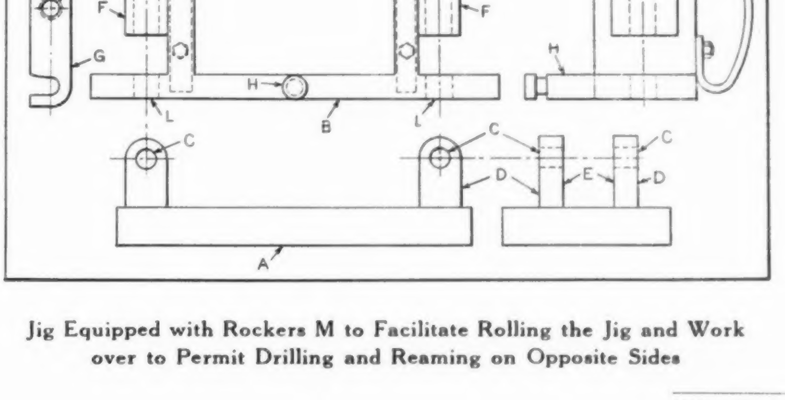
Increasing Production by Simple Changes in Jigs and Tools

By VERNON E. DAVIS, Poughkeepsie, N. Y.

It is always in order to make changes which will increase production, especially when they facilitate the maintenance or improvement of the quality of the product without undue expense. Changes made in the jig and tools employed for drilling and reaming four holes in a cast-iron part, as described in this article, give some idea of the possibilities of obtaining increased production by comparatively simple changes in equipment.

The part *A*, shown in the illustration, is clamped in the jig *B* for drilling and reaming the four holes *C* in the lugs *D*. The faces *E* of the lugs are machined to fit over the lugs *F* of jig *B*. The lugs *F* serve to locate and support the work while it is being drilled. The strap *G*, for clamping the work in place on one side of the jig, has slots at each end which fit the grooves in studs *H*, and a tapped hole *J* for a set-screw which is tightened on the work. The jig is used in the position shown, bushings being inserted in holes *K* for guiding the 59/64-inch drill used for the drilling operation.

The procedure, previous to the changes to be described, consisted of drilling the two holes *C* on one side of the work, using a feed of 0.006 to 0.008 inch per revolution. After this, the machine was stopped and the drill replaced with a 15/16-inch reamer, 0.010-inch over size. The guide bushings were also changed to suit the reamer. After reaming the holes, the machine was again stopped and the jig and work turned over for drilling and reaming the two holes *C* on the opposite side. These holes were drilled and reamed in the same manner as the ones on the opposite side, the bushings for the drill and reamer being placed in holes *L*.



Jig Equipped with Rockers M to Facilitate Rolling the Jig and Work over to Permit Drilling and Reaming on Opposite Sides

With this method, the drill and reamer were inserted and removed from the spindle four times each, and the machine was stopped four times in drilling and reaming one piece. The drift and hammer used for loosening the drill and reamer from the spindles when tools were being changed had to be picked up and laid down four times, and the shifter lever had to be operated eight times. With this inefficient method, the production was only thirty pieces in nine hours.

The changes in equipment that resulted in increasing the production from thirty to ninety pieces in nine hours will now be described. The first change, intended to make it easier for the operator to turn the jig over, was the addition of the rockers *M* to the jig. These rockers are made of flat iron and were designed to permit rolling the jig over instead of lifting it and turning it over in the usual manner. As the jig and work weighed 50

pounds, this improvement made it possible to perform the drilling and reaming operations much more quickly and easily.

A special table, 4 feet by 2 feet in size, was fastened permanently to the bed of the machine, its position being low enough to permit the swinging table of the machine to pass over it. The jig was then placed on this table. An angle-plate somewhat higher than the jig was bolted to the table to take the thrust of the end of the jig located the greatest distance from the drill. A block was also bolted to the table to take the thrust on the end of the jig next to the drill and to resist any tendency of the jig to twist or turn.

The standard taper drill socket was next replaced with a slip socket having a taper shank that fitted the spindle. This socket has a straight hole instead of the regular taper hole, and is used to hold a smaller one containing the drill. The smaller socket is held in place by a pin which passes through a hole in the larger socket and enters a groove in its shank. The smaller socket and drill or reamer can be removed by simply lifting a loose ring which normally keeps the pin in place. This can be done without stopping the machine.

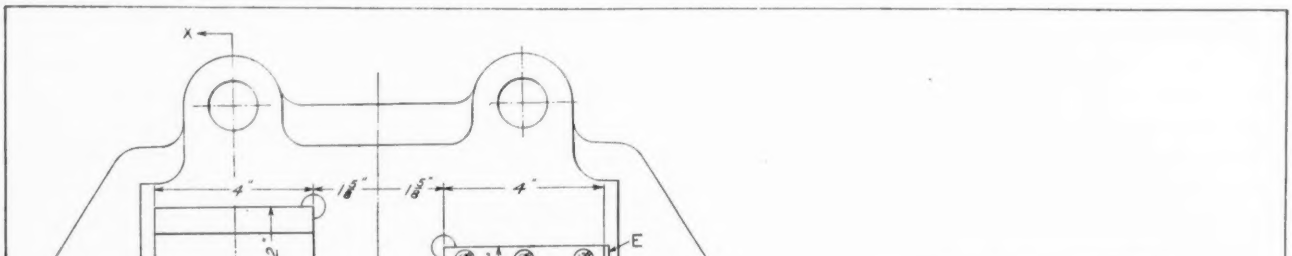
The spindle speed was also increased until it reached 320 revolutions per minute. A faster speed was tried, but the drill would not stand up under the higher speed. The feed was set at 0.032 inch per revolution, giving a cutting depth of 0.015 inch for each lip. The drill used was selected for the job by a drill manufacturer. The drill must be sharpened very carefully, in order to stand up under the speed and feed now used. For this work, the angle of the lip is increased. When the heated drill is removed from the socket, it is placed in a can of water to cool while reaming is being done.

Twisting and Straightening Die

By LOUIS H. LE POLD, Tool Designer
Stonite Products Co., Philadelphia, Pa.

The die shown in the accompanying illustration is used in producing the boiler stand bracket shown at *W*. It twists, flattens, and straightens the flat piece of hot-rolled steel stock to the given specifications in one stroke. This die has replaced the cam type die formerly used, which did not stand up well, although it cost a great deal more to make.

The die consists primarily of two V-blocks *A* having a stationary hold-down strap *B* and a strap



Die for Twisting Flat Strip of Hot-rolled Steel to the Shape Shown at W

C which has a handle and can be pivoted about screw D. The handle on strap C permits this member to be pivoted or swung open so that the flat stock can be located in the die. After the work is in place, the handle is swung back into the position shown and the press tripped. The stop E locates the work endwise, and the 1/8-inch plate F serves to balance the punch at the small end of the twisted portion of the work.

The punch member consists of two 90-degree V-blocks G which are shaped to fit the vee in the die-blocks. The V-blocks in the punch member are mounted in guides H which permit them to slide back and forth. On the downward stroke of the press, the punches follow the V-block sides which make the twist. When the press ram reaches the end of the downward stroke, the work is flattened against the sides of the V-blocks. This automatically straightens the work.

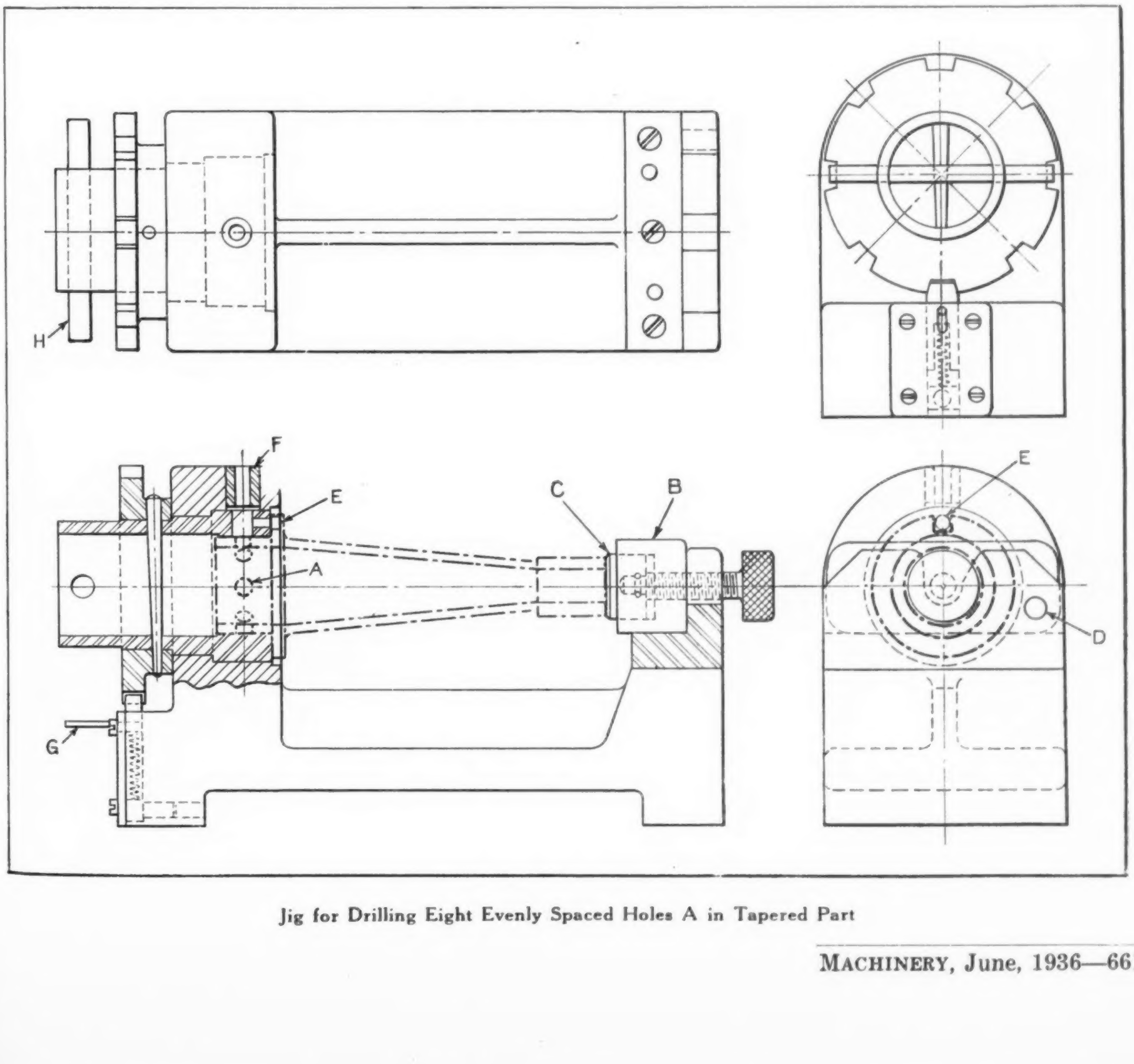
When the press ram ascends, a spring attached to studs J and K pulls the punch-block over to the stop L, which is set in such a position that the point of the punch just strikes the side of the V-notch in the die when the press is at the top of its stroke. This die is inexpensive to make and works very successfully. The hot-rolled steel stock used for the part W has considerable scale which peels off during the bending or twisting operation. This scale, however, falls between the two lower dies and does not interfere with the operation.

Indexing Jig with Revolving Work-Retainer

By F. SERVER

A simple indexing arrangement and a revolving work-retainer are features of the jig shown in the accompanying illustration. This jig is used in drilling eight evenly spaced holes A in the work, which is indicated by the heavy dot-and-dash lines. The block B which carries the revolving work-retainer C on the end of the knurled screw can be swung back about the pivot pin D to permit placing the work in the jig.

The end of the work to be drilled is a sliding fit in the indexing sleeve, and is located radially by pin E which enters a slot in the flange on the work. After placing the work in the indexing sleeve, the block B is swung back into the position shown. The knurled-head screw is then tightened, so that the



Jig for Drilling Eight Evenly Spaced Holes A in Tapered Part

revolving retainer *C* presses against the end of the work and holds it in place.

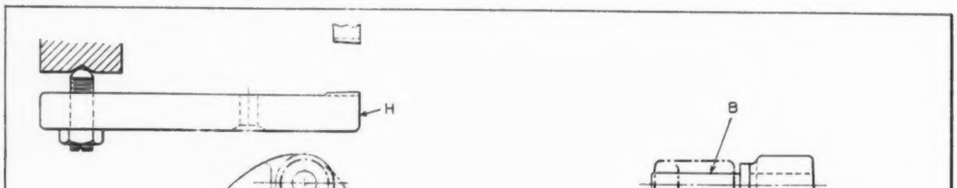
The eight holes are drilled, one at a time, with the drill guided by the bushing *F*. After drilling a hole, the indexing pin is disengaged by pushing down on the pin *G*. The work is then revolved for drilling the next hole, a crosswise pin *H* serving as a handle to turn the indexing sleeve around until the indexing pin snaps into the succeeding slot. A larger number of holes can, of course, be drilled by providing an indexing plate having the required number of slots.

Milling Fixture with Quick-Acting Equalizing Clamp

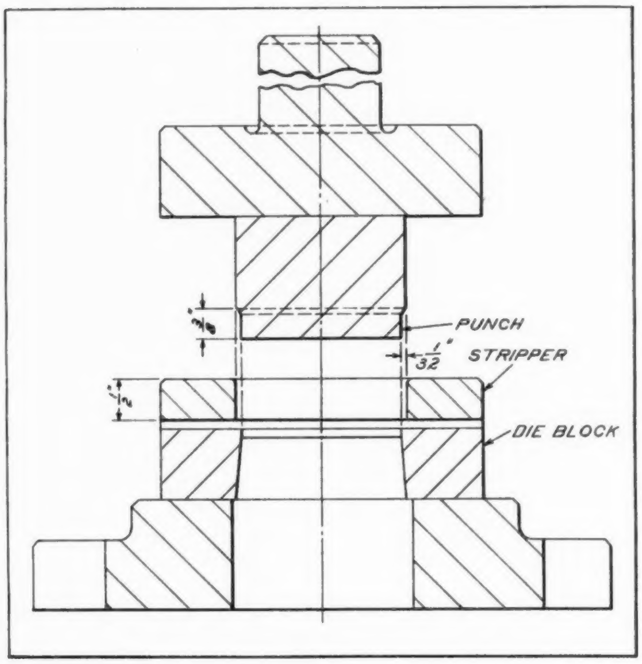
By C. E. GOEMAN, Ozone Park, L. I.

The fixture with the quick-acting clamping device shown in the accompanying illustration was designed to hold the work *W* while milling the seat *A* parallel with the reamed hole in the boss that is located on pin *B*. The clamp *C* is allowed to pivot on stud *D* to compensate for the irregularity of the rough bosses on the work. It is kept in its normal position when loading by spring *E*, which is pressed into a slot in the clamp. The outer end of this spring fits into a slot in post *F*.

The work is clamped by tightening screw *G* which operates the three-point swivel type clamp *H* shown in detail in the view in the upper left-hand corner of the illustration. Both clamps have beveled faces designed to exert pressure against the stop-pin *I*. A spring *J* keeps the clamps apart while the work is being inserted. A long spring can be used in place of spring *J* if the steel tube *K* is removed from screw *G*.



Fixture for Holding Part W while Milling Surface A



Blanking Die with Stripper that Acts as Guide Bushing

Shear-Proof Blanking Die

By WILLIAM STEUER, Tool Designer
Electric Service Supplies Co., Philadelphia, Pa.

An inexpensive, open, shear-proof blanking die is here illustrated. The greatest difficulty encountered with ordinary open blanking dies is in the accurate centralizing of the punch and die. Inaccurate centralizing causes the punch and die to be sheared, especially when they are designed for very thin material with little break clearance. Such dies, when subjected to this shearing action, must be reground before they will produce stampings that are free from burrs.

If the punch and die are not accurately aligned, there will be a large ragged burr on one side, while the other side will be cleanly cut. These difficulties can be overcome, however, by constructing the die as shown in the illustration. The die is of conventional design, except that the punch has a raised shoulder that is larger than the blank diameter, as shown in the illustration. The stripper plate is bored central with the die opening and to a close sliding fit for the shoulder on the punch. Thus the stripper plate acts as a guide for the punch.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

W. H. R.—Where would it be possible to obtain detailed information concerning the construction and operation of the Sanford-Mallory flax-braking machine? This machine is an old invention and probably originated in England some seventy years ago. The address of the firm or individual who may be able to give such detailed information would be appreciated.

This question is referred to MACHINERY'S readers.

What is Percussion Welding?

H. C.—I would like to have explained exactly what is meant by "percussion" electric welding.

A.—Briefly, percussion welding is a form of electric resistance welding in which the duration of the current flow is extremely brief; hence this electric welding method may be applied to metals having low welding temperatures.

As pointed out by the Thomson-Gibb Electric Welding Co., Lynn, Mass., in one of its recent publications, the increasing use of alloys of aluminum, copper, and other corrosion-resistant metals, has stirred up considerable interest in percussion welding. Under certain conditions it is possible with this form of welding to join these metals faster, better, and with less power consumption than by any other process. Early applications of the process were limited in number by the lack of suitable means for controlling the duration of flow of large volumes of current. During the last few years devices have been developed that restrict the duration of current flow to one cycle or even a fraction of a cycle.

Percussion welding makes it possible to obtain a good weld, because the area heated to a welding temperature is limited as nearly as possible to the surfaces to be joined. A further advantage is that there is less of an upset or burr in the case of a butt weld, and less indentation on the outside surfaces in the case of spot welds.

Originally, percussion welding was used only for comparatively small areas, but today larger cross-sectional areas are welded by this process. The surfaces or edges to be joined must, however, be carefully prepared so that they are in contact over their entire area. Also, the welding machine must be unusually rugged, and generally must be equipped with special fixtures to hold the parts in accurate alignment. In welding large areas by the instantaneous percussion method, much greater transformer capacity must also be provided than if the same weld were made in a longer unit of time. For these reasons it is not always economical to use percussion welding on large sections, but where applicable, the process is extensively used. Stainless steel and copper alloy parts for refrigerators, household utensils, and similar products are now handled in this way.

Discharged Employe's Right to Bonus Payments

G. A. D.—Our company has made contracts with employes offering to pay bonuses at the end of each year. Suppose that we discharge an employe near the end of the year. Are we required to pay the accumulated bonus?

Answered by Leo T. Parker, Attorney-at-Law Cincinnati, Ohio

In the case of Muir v. Leonard Co. [257 N. W. 723], reported in March, 1935, it was shown that a company made contracts with its employes which provided that certain bonuses would be paid for the year ending September 30. However, the contract contained a clause: "Should your connection with this company be terminated by either party prior to September 30, the payment of any bonus is entirely at the discretion of this company."

The company discharged an employe without any cause before September 30. The employe sued to recover the amount of the bonus which he claimed to be due. However, the Court refused to hold the company liable on the bonus contract, and said: "Courts will construe a written contract according to the intention therein expressed, when that intention is clear on its face ... Where a contract is not ambiguous, it must be construed according to the ordinary meaning of the words used."

Therefore, according to this decision, if an employe agrees in a contract that should he be discharged before the date for bonus payments arrives, his bonus will be forfeited, then, although the employe is discharged without just cause, he cannot recover the bonus payment.

Dimensioning Dovetail Slides

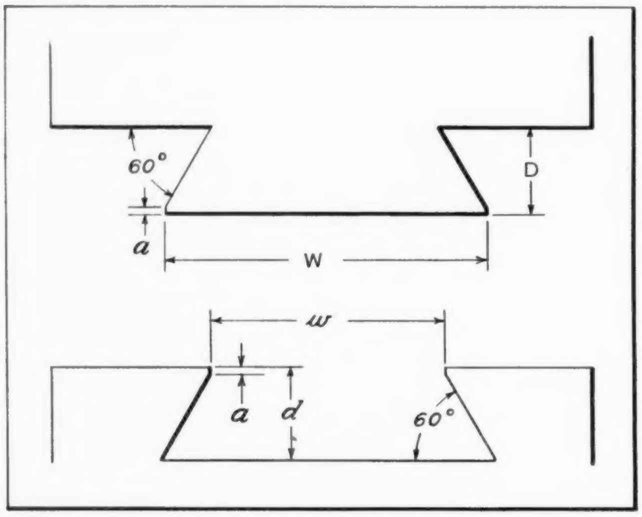
W. S. D.—Should the dimensions on the drawing of a dovetail slide which is made of cast iron and scraped, or of steel, hardened and ground, show the finished size; or should the figures on the drawing allow for the scraping or grinding of the slide?

The top slide not only fits in the dovetail, but also fits against a flat surface. The bottom slide is a detachable piece fastened to the bed; it also fits against the flat surface on the side.

Some designers say that the drawing should give the dimensions of the finished piece, while others claim that unless the figures show the milled dimensions, the milling machine operator may not leave sufficient stock, and the piece may be spoiled. What is the general practice?

Answered by J. Homewood, Ontario, Calif.

In dimensioning dovetailed parts, one has to consider the production conditions under which the



Method of Dimensioning Dovetail Slides

parts are to be machined. It may be that the drawing is for a tool part, which, in all probability, will be made but once, or the part may be a product wherein interchangeability is involved. To specify limits when only one or a few parts are to be machined needlessly consumes the time of the skilled workers, whereas if the part is one of many of the same kind, economical production will be facilitated by working to close limits.

If we can classify the former as ordinary work, in which the amount of stock left for scraping or grinding is left to the judgment of the mechanic, and the latter as extraordinary work, we are arriving at a point where methods in dimensioning should differ. It is the writer's opinion that the upper member of the dovetailed pair shown in the accompanying illustration should be dimensioned across the tips as at W rather than across the inaccessible corners. In dimensioning a drawing, one has to bear in mind constantly that the drawing is made not for the draftsman, but for the one who is to read and use it.

The lower part should be dimensioned across the throat as indicated by w, while the depth d of the dovetail should be greater than the depth D of the upper member. The writer sees no need for sharp corners, and would give a dimension, as shown at a, from which the angular cut would be started if done on a shaper or planer. Also, it is desirable to give all dimensions in whole numbers and fractions, specifying the type of fit required.

In dimensioning the parts for interchangeability, assuming them to be machined on a miller, the same dimensions would suffice, taking into account the additional depth to which the bevel cutter must be sunk. However, instructions should be given to machine operators that the part is to be machined to "Go" and "No Go" gages which are made to provide allowance for scraping or grinding.

Drawings for the "Go" and "No Go" gages should be provided in light outline, circles being drawn to represent the measuring plugs. The diameters of the plugs and measuring distances should be given for the toolmaker's convenience. Dimensions should be specified to fine limits, in order to insure uniform size and interchangeable production of the part for which the gages are made. The formula for calculating the distances required between plugs is given in MACHINERY'S HANDBOOK.

Machining Brake-Drums

B. D.—We have experienced some difficulty in machining alloy-iron brake-drums which contain 3.50 per cent nickel and 0.60 per cent chromium. Most of the parts that have given trouble have been removed from the mold while cooling. Has this anything to do with the difficulty?

Answered by the Editor of "Nickel Cast Iron News," Published by the International Nickel Co., Inc.

It is our belief that you have located the cause of the trouble. An iron of this composition should not be disturbed in the mold until it is below a red heat, if danger of air-hardening at the exposed points is to be avoided. Of course, an iron with a high alloy content will have to be machined at a somewhat slower speed than a plain gray iron.

In addition to the above precaution, it is good practice, on a brake-drum iron that will be subsequently heated by the braking action, to give it a stress-relief anneal before machining, by heating the castings slowly to a temperature of 1000 degrees F. This anneal will remove casting strains without softening the material.

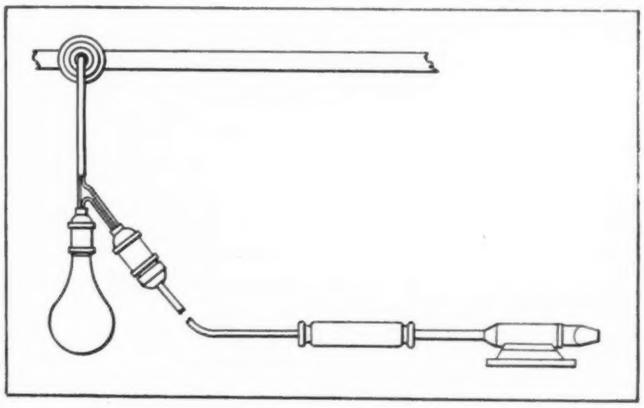
If some softening is desired, the temperature should be raised to 1200 degrees F., but this temperature should be applied carefully and not be exceeded, as this would weaken the iron.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Preventing Soldering Irons from Overheating

When an electric soldering iron is being used intermittently, the temperature of the iron can be kept from rising too high by placing an electric lamp in series with the circuit. By constructing a series extension cord, as shown in the illustration, with a connector cap attached to one end and two sockets attached to the other end, the iron can be used by plugging its connector cap into one of the sockets and placing a suitable size lamp in the other socket.



Method of Using Lamp in Circuit of Electric Soldering Iron to Prevent Overheating

Some experimentation may be necessary in order to determine the proper size lamp to use. This will be regulated by the wattage of the iron and the amount and type of work being done. It may be necessary to use a heavier resistor than a lamp when a large iron is used, and for this purpose a heater element of the screw-thread base type may be satisfactory.

Baltimore, Md. THOMAS TRAIL

Lubricating High-Temperature Bearings

A lubrication expert recently stated that in lubricating ball and roller bearings mounted adjacent to high-temperature equipment (like electric motors, for example), he supplied lubricant on *stopping* the drive instead of when *starting* it. He did not merely add a few drops with an oil-can; he turned on a sight-feed oiler.

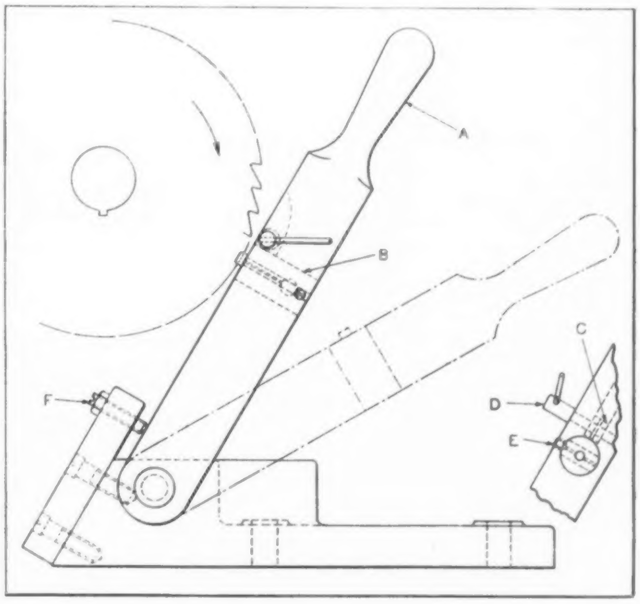
The reason for doing this, he stated, was to prevent the grease from hardening. In his opinion, if the oil were applied directly to the grease while the motor was in motion, it would not have a chance to be absorbed by the grease, because centrifugal force would throw off the oil. In this manner, he has been successful in taking care of ball and roller bearings operating at very high temperatures.

Newark, N. J. W. F. SCHAPHORST

Fixture for Slotting Screw-Heads

The simple fixture here illustrated is used in a manufacturing plant for holding small screws while slotting their heads with a rotating saw. The hand-operated arm *A* is swung upward to feed the screw to the slotting saw. The arm is equipped with a spring chuck *B* having a center hole that is slightly larger than the outside diameter of the screw to be slotted. The eccentric collar *C* is pinned to stud *D*. Depressing the handle of stud *D* serves to clamp the chuck jaws on the screw to be slotted. The set-screw *E* used for locating the spring chuck in the operating arm permits changing chucks to suit different sizes of screws. The depth of the slot is controlled by adjusting the stop-screw *F*.

Richmond Hill, N. Y. PHIL. E. VERAA



Simple Fixture for Use in Slotting Screw-heads

The Search for Better Quality in Tool Steels

Some of the Problems with which the Steel Mill Metallurgist is Already Familiar, and Others with which he will Probably Soon be Confronted in Meeting Present-Day Requirements for Tool Steel

By C. A. LIEDHOLM, Metallurgist
Jessop Steel Co., Washington, Pa.

WITH vague doubts in his mind, the writer, several years ago, saw a steel company meekly accept the return of large quantities of "dirty" tool steel which had been condemned by the purchaser on the evidence of inclusions, detected on cross-sectional micro samples which were full of scratches. Before the customer's "dirt consciousness" had become somewhat tempered by experience, inclusions were a nightmare to the metallurgists of steel maker and consumer alike.

Today, the importance of non-metallic inclusions in steel is viewed with more understanding and in the light of greater accumulated experience, both by user and manufacturer. The factors influencing steel cleanliness can now be dealt with rationally. Sufficiently clean steel is now the rule, with few exceptions, even when the price is fairly low. Extraordinarily clean steel for special purposes, such as cold-header dies, can be made at somewhat higher cost through a special process in which the central part of the ingot is removed.

There are, however, a great number of applications in which extreme cleanliness of the steel is of secondary importance. Many metallurgists have had the opportunity to examine tools that gave excellent performance, but that did not show marked cleanliness of the steel. From this fact, one may infer that there are other factors, the influence of which on steel performance frequently—if not always—overshadows that of cleanliness.

Some such factors are "the characteristic austenite grain size," and the "hardenability," or "P-F characteristics," of the steel. A close relationship has been established between the characteristic austenite grain size and the hardenability of steel, and the great amount of work performed in this field in recent years has indicated new possibilities in the direction of improved performance and a more intelligent manufacture and application of carbon tool steels for various purposes.

Much experimental information has already been accumulated, some of which has been published, but data on practical applications and possible lim-

Fig. 1. (Left) About 220,000 3/4-inch Bolts were Headed by This 3 1/2-inch Round Button Header. Fig. 2. (Center) Open Header Dies, 1 7/16 Inches Square, that Were in Constant Service for 140 Hours, Producing 17,000 Pounds of Screws Before Worn Out. Fig. 3. (Right) One of the Dies Shown in Fig. 2 Split and Etched. The Hardened Case is Comparatively Shallow but Deep Enough to Withstand the Tendency to Chip Off, Crack, or Sink

itations to the usefulness of controlled grain size steels are scant, especially when it comes to tool steels. Such data therefore have to be assembled by the individual manufacturers in collaboration with their customers; and not much of this information is likely to be published.

It seems obvious, for instance, that while an inherently very fine-grained and consequently normally shallow hardening steel may be excellent for a small die or for a tool subject to repeated shock, it may not be so well suited for a large die. At least, it has been the Jessop Steel Co.'s experience that unless a die has a certain minimum depth of hardened case, depending on its size and use, chipping of the case is likely to occur; other such dies may sink.

The example shown in Fig. 1 illustrates this. It is a 3 1/2-inch diameter header having a heavy case. This die showed great superiority in performance over similar dies having a shallow hardened case. Not less than 220,000 3/4-inch bolts were headed with this button header, which was made from a comparatively deep-hardening steel. Shallow-hardening steels begin to sink and crack after a production of from 30,000 to 35,000 bolts.

Again, the small open header dies shown in Fig. 2 were made from a steel of controlled grain size type, and their performance was exceptionally good. They produced 17,000 pounds of screws in 140 hours of constant service before they were worn out. They were hardened at 1550 degrees F. and drawn at 425 degrees F. for forty minutes. They had a hardness of C-58 Rockwell. As may be seen from the etched section in Fig. 3, the hardened case is comparatively shallow, but it is deep enough to withstand the tendency to chip off, crack, or sink, which might have happened if the hardening temperature had been lower than 1550 degrees F.

There are, of course, many applications in which a fine-grained steel is vastly superior. One of them is for composite carbon tool steels, as made by the Jessop Steel Co. for various applications. Here the fine-grained steels are superior because they do not coarsen in a heat-treatment that will satisfactorily refine the soft backing, core, or insert, as the case may be, and will not cause excessive distortion in the hardening of the composite unit. Another application is for pneumatic tools in general, where the controlled grain size, shallow hardening steel has proved its merit.

When the limitations of the shallow type steel are referred to, it is, of course, assumed that conventional heat-treatments are used. The possibility of hardening these steels at much higher temperatures than is customary for high-carbon tool steels today must, however, be reckoned with. By thus increasing the carbon content of the martensite without weakening it through undue coarsening, it may be possible to make gains in wear resistance without incurring a loss in strength, an achievement that should greatly improve the production of many dies and other tools, especially those subject to excessive wear.

By increasing the manganese content of an inherently fine-grained steel in order to increase the hardness penetration one can, with certain limitations, combine the desired properties of ordinary fine- and coarse-grained steels. It is doubtful whether this possibility has been fully utilized, or whether it has been established how far one can proceed in the indicated direction. The effect of a certain increase in manganese in slowing down the rate of ferrite formation would appear to reach a maximum at some intermediate, fairly high manganese content; in other words, at a certain manganese content, a slight further increase in this element might effect such a radical change that it would be difficult to control the results. In addition, the present specifications of major users of carbon tool steel are, in many cases, no doubt an obstacle to such procedure, but if developments in this direction prove successful, this difficulty should be gradually eliminated.

Another problem is the eventual importance of the core hardness and hardness gradient between case and core. Some factors that have an apparently small but distinct influence on these features are under investigation at this time, but further work is required to establish the immediate practical value of the data so far obtained.

To sum up, there is no question that improvements in tool steel quality have resulted from the investigations already made, and we may well assume that before long, the awareness of the importance of controlled grain size and hardenability will gain sufficient momentum to cause the rewriting of many specifications along the new lines. We hope to avoid, then, experiences along the lines cited in the beginning of this article, in connection with "dirty" steel.

* * *

Welding Research Extended

Plans to expand its organization for the advancement of welding research have been announced by the Welding Research Committee of the Engineering Foundation, 29 W. 39th St., New York City. A new industrial sub-committee has been formed to coordinate industrial welding research throughout the country.

Sixty investigations are reported to be under way in universities alone, and many more researches are being conducted in industrial and federal laboratories. Seven divisional committees are being organized to conduct studies in special fields, and three functional sub-committees of the industrial committee have been formed to consider methods of testing; analysis of weld failures; and the causes and effects of weld stresses. A sub-committee on literature is at work on a critical digest of the world's welding literature, which it is planned to publish in the interests of American industry.

Machine Tool Builders' Association Receives Outstanding Award

THE National Machine Tool Builders' Association has been presented with the American Trade Executives Award for outstanding achievement by a trade association during the last three years. The presentation of the award was made by Secretary of Commerce Roper to Herman H. Lind, general manager of the Association, at a dinner of the American Trade Association Executives, held in Washington and attended by 300 leading business representatives and trade association executives.

© Bachrach

Norman D. MacLeod, President National Machine Tool Builders' Association

Medal Awarded to the Association for Service to Industry and Promotion of the General Welfare

Herman H. Lind, General Manager National Machine Tool Builders' Association

The award was given to the National Machine Tool Builders' Association not only because of the services the Association has rendered to the machine tool and allied industries, but also for the promotion of the general welfare, chiefly through the courageous staging of the Machine Tool Show in Cleveland last fall. That exposition was the largest single-industry show ever held in the United States. It was visited by 60,000 persons and marked a definite step toward industrial recovery.

In presenting the award, Secretary Roper said: "During the last three years the machine tool industry faced the most difficult task of rebuilding a sales volume which, in 1933, had fallen to one-seventh of the 1929 total. Immediate plans were made by the Association to restore activity in the machine tool industry to the high level before the depression. The climax of almost two years of united effort by the Association to recreate a demand for up-to-date plant facilities was reached in the holding of the National Machine Tool Exhibition in Cleveland, Ohio, last fall. It was a most successful achievement and illustrated to industry and to the public the important advances that had been made in machine tool design and performance since 1929. The leaders in this Association did not wait for more favorable conditions. They set out to create favorable conditions through their own efforts, thus displaying that courage which should be typical of American business endeavors. This is an achievement which justly deserves the award which is presented to this Association."

* * *

I have no faith in the capacity of political government to give us either stability or progress when it sets out to manage agriculture and industry. I think it is imperative that government shall take a definite hand in the broad guidance of economic policy, but we must not permit government to go beyond its proper sphere, and attempt to dictate the detailed procedure of this nation's enterprise.—*Dr. Glenn Frank, President University of Wisconsin.*

Gear Noise—Its Causes and Correction

At the Annual Meeting of the American Gear Manufacturers' Association, W. E. Sykes, of the Farrel-Birmingham Co., Presented a Paper Dealing with the Causes of Gear Noise. The Present Article is an Abstract of this Paper

ALMOST everyone responsible for the manufacture and performance of gears is troubled by gear noise. Those engaged in gear manufacture are likely to think that noise is a particular difficulty of theirs; but almost every branch of industry has its noise problems. This paper, however, will deal only with gear noises.

The causes of gear noise are: (1) Faulty design; (2) faulty workmanship; (3) faulty lubrication; and (4) overloads.

Faults in Design that Are Likely to Cause Gear Noise

The expression "faulty design" as here used applies not only to the gears themselves, but also to the shafts, bearings, and housing. The design of the gear teeth should be in accordance with correct geometric principles. In addition, helical teeth should be utilized, because it is easier to obtain silence with gears having helical teeth than with those having straight teeth.

Occasionally straight-tooth gears are made with such a small number of teeth that the base circle pitch is larger than the length of the line of action, in which case silent operation is impossible. For quiet operation, it is preferable to arrange for at least two base circle pitches along the line of contact. This necessitates a somewhat large number of teeth in the gear pair. When there is a practical limitation of the number of teeth, a modified addendum and dedendum must be used. In general, the sum of the number of teeth in any gear pair should not be less than 60, although fairly good results may be obtained with a smaller number of teeth.

A reasonably rigid gear and pinion structure should be provided. In using the term "pinion" in this case, worms are included, and the term "gear" is intended to include worm-wheels. The pinions should be large enough in diameter, proportionate to their length, to avoid excessive deflection, and the gears should be so designed that they will not become unduly deflected under full load and will not warp appreciably out of shape after having been cut and heat-treated.

The bearings must be close enough together to prevent excessive deflection of the shaft, and they must be sufficiently well supported to prevent excessive deflection under full load.

The gear housing should be oil-tight and dust-proof, with sufficient oil capacity and ample heat-radiating surface. If necessary, an oil cooler should be included in the design.

In selecting materials for gears, it is important to consider whether the materials can be handled satisfactorily during the manufacturing process. For example, it would be a mistake to select a forged steel that had been heat-treated to such a degree before the gear-cutting operation that it would damage the tools and thereby cause inaccuracies. It would also be a mistake to choose a material that is likely to warp unduly if it has to be heat-treated after the cutting operation. When cast materials are used, it is advisable to insure reasonable uniformity in hardness and cutting characteristics.

When Anti-Friction Bearings Become Especially Useful

The designer must also take steps to prevent extraneous forces from pushing the gears out of position when assembled in the drive. This, for example, may involve the consideration of the type of couplings used and the possibility of side thrust due to overhanging loads. In cases of this kind, anti-friction bearings are often useful, and in many instances, tapered roller bearings are especially valuable. In other cases, deep-grooved ball bearings can be used advantageously. When sleeve bearings with forced lubrication are employed, due to high velocity, suitable flexible couplings should be used; sometimes it is advisable to provide a thrust bearing of the Kingsbury type.

Consideration should also be given in the design to the possibility of finish-cutting the gears after they are mounted on their shafts, in order to cut them true relative to the journals. For this purpose, shafts that are too long to be accommodated in a gear-cutting machine should be avoided.

Occasionally gears are blamed for noises that they do not create. Often the noise attributed to the gears comes from the bearings; hence the designer must make sure that the bearings themselves are not likely to create a noise.

Sometimes oil noises are caused by the gears being immersed in too heavy a lubricant; for this reason, the designer must specify both the oil level and the lubricant. For high-velocity gears, spray

lubrication should be provided. The designer must ascertain whether or not spray lubrication is required. When a forced lubrication device is used in a gear unit design, it is important to investigate that the device itself will not create a noise.

A High Grade of Workmanship is Imperative for Silent Gears

Although it is impossible to get satisfactory gear performance without correct design, it is equally impossible to obtain silent gears without the highest grade of workmanship. Most gear noises are caused by faulty workmanship. In the author's experience, more than 90 per cent of noisy gears are due to inferior workmanship. Good workmanship applies not only to the gears themselves, but to the housing, bearings, shafts, alignments, and installation. Quality of workmanship covers not only general precision, but a degree of finish or polish on the tooth surface equal to that required in the manufacture of precision ball and roller bearings.

The gear-cutting machines must be of the highest grade, and it is, of course, equally necessary that the cutting tools be accurate within very close limits. The gear teeth must be cut concentric with the axis, and the indexing must be accurate—preferably the largest inaccuracy in division or tooth pitch should not be more than 10 seconds of arc. The tooth contours must be precise. Careful observations indicate that a 0.0001 inch error is too much in some cases. Gears having helical teeth are essential, and it is nearly as important to have the helices accurate as the tooth contours. It is also important that they be accurate in relation to the axis on which the gear will actually operate.

The only way to obtain a silent gear is by a final lapping operation. This seems essential, whether the gears are hardened or not, and is also essential whether or not the gears are ground. The lapping of gears is an art at present, and will probably remain so to some extent.

The foregoing paragraphs have reference to very high-speed gearing that has to carry heavy loads relative to its size. Lower speed gearing will run silently in a commercial sense, when not made quite so precise, but, nevertheless, a relatively high degree of accuracy is desirable for all gearing.

The Correct Mounting of Gears is of the Greatest Importance

The utmost precision in the manufacture of the gears themselves can be nullified by inaccurate mounting. The relative position of the shafts needs to be as precise as the gearing itself. It is obviously useless to make an accurate pair of gears to operate on exactly parallel shafts and then mount the shafts out of parallel. It is equally futile to expect a pair of gears to operate on shafts having axes that should cross at an exact right angle, but that are set at some other angle; similarly, gears that are made to operate on shafts having axes that intersect cannot operate properly when mounted on shafts having axes that are offset.

Although the manufacture of practically silent gearing requires great care, it is not quite so difficult as is sometimes believed. The utilization of the best present-day equipment and methods should produce, say, 80 per cent of gears of excellent quality, 15 per cent moderately satisfactory, and the remainder just passable.

A Few Notes with Regard to Lubrication and Overloads

No gear will run silently under load unless it is well lubricated. The question of lubrication in relation to design has already been referred to. It is only necessary to add that clean lubricants in a clean housing are necessary. If the lubrication is too thick, it will not spread over the teeth properly. If a very thin lubricant is used or if a relatively thick lubricant is overheated, the lubricating facilities will not be satisfactory.

Those who have had experience in testing gears for silence know that any particular pair of gears may run silently at certain loads and become noisy at overloads. Some gears will run silently at no load, but will make a noise when carrying only 10 per cent of the designed load. Others will run silently at only 50 per cent of the load and become noisy at 100 per cent. Others, again, will run silently at full load, but will be noisy at 50 per cent overload. Still others will run silently at any load that does not result in damage to the tooth surface, the shafts, or the bearings. It is, therefore, necessary, in investigating a noise complaint, to make sure that the gears are not overloaded and that they have not been overloaded and thereby damaged.

While speed undoubtedly makes a difference in the noise of gears, really accurate gears, properly designed, will run quietly at full load up to very high velocities. There are many sets running satisfactorily up to 12,000 feet per minute, and there seems to be no good reason why such gears should not run satisfactorily up to 18,000 feet per minute.

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Franklin Institute Ball-Bearing Exhibit

An operating display of self-aligning ball bearings is attracting attention in the Wonderland of Science of the Franklin Institute, Parkway and 20th St., Philadelphia, Pa. The exhibit was presented to the Institute by S K F Industries, Inc. In the display, the bearing housings are thrown out of alignment by eccentric mechanisms, in order to show how the bearings continue to act smoothly. In addition, there is a display showing the evolution of a ball bearing from the first casting to the final burnishing.

Steel Casting Rush Orders Should be Discouraged

By RAYMOND L. COLLIER, Secretary
Steel Founders' Society of America

Commenting on the editorial that appeared in May MACHINERY, page 586, it may well be emphasized that hand-to-mouth buying is an especially serious matter in connection with steel castings. Hand-to-mouth buying means rush orders, and rush orders for steel castings are not conducive to obtaining the very best product that the steel foundry is capable of turning out.

Rush orders of this character place the foundryman in a difficult position. On receiving such an order, he has two alternatives: He can accept the order and do the best he can in producing acceptable castings within the delivery time specified; or he can insist on omitting no essential steps in the orderly process of making the highest quality of castings, fully adapted to the service required—even though he cannot meet the delivery date.

Too frequently the foundryman hesitates to take the matter up with the customer, feeling that he would antagonize him by suggesting a procedure that might delay delivery. So he goes ahead and does the best he can. He may compromise with his best judgment, in order to meet the mandatory delivery date. If he does, and the castings delivered are not up to the standard, is it fair to blame him?

The remedy to be suggested is that users of steel castings look into the future as far as they can and anticipate their requirements in advance of actual need. If new designs are being developed, it is suggested that they call in the steel foundryman while the drawing is still on the drafting-board, in order to get the advantage of his experience. This will help to assure that the castings will be the best that advance precautions and good foundry technique can supply.

Briefly, the thought the writer wants to convey is that it takes time to make good castings, just as it does to make a good suit of clothes. The foundryman should be given enough time for the job, so that he does not have to make castings that will detract from his reputation as a manufacturer of a quality product. Much of the criticism directed against castings in general has been due to forcing the foundryman to produce castings under pressure, without sufficient time to produce the high quality work that could be turned out under favorable circumstances.

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According to an item in *Industrial Britain*, a new type of two-seater private airplane, to sell for less than $2000, is being built by F. Hill & Sons at Trafford Park, Manchester, England. The machine will fly forty miles to the gallon and can achieve a speed of 90 miles an hour.

Peter Hall of the Hall Planetary Company Honored

Peter Hall, president of the Hall Planetary Co., Philadelphia, Pa., has been awarded the Edward Longstreth Medal by the Franklin Institute of Philadelphia "in consideration of his invention and development of machine and cutters for planetary milling and threading." The Hall Planetary machines are well known throughout the industry, the machines as well as the work they perform having been the subject of many articles in the technical press. The award was formally presented to Mr. Hall by the Franklin Institute in connection with the Medal Day exercises Wednesday afternoon, May 20. The Edward Longstreth medal was founded in 1890 by the late Edward Longstreth of Philadelphia, who was long connected with the Baldwin Locomotive Works. The object of the medal is to encourage invention and engineering progress.

Peter Hall, Recipient of the Edward Longstreth Medal

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Metal-Protecting Finish for Machinery

A material known as "Aspro Metal Finish," having qualities that adapt it for finishing machinery, has just been placed on the market by the Asphalt Products Co., Inc., Grand Central Terminal, New York City. This finish may be applied by a spray gun or brush, and may be baked or air-dried. It becomes dry to the touch in four hours, and attains maximum hardness within twenty-four hours. It is obtainable in black, gray, brown, red, and green, and has the appearance of glossy enamel. It has an asphalt base, but is harder than previous finishes of this kind; yet it does not crack, check, or peel. It is non-fire-supporting, and when subjected to high temperatures, merely smolders.

The protective coating formed by this material is resistant to most of the destructive reagents encountered in industry, and is insoluble in oil and the lighter distillates of petroleum. Cutting compounds, soap, and other alkaline solutions have no effect on it, and the acids in ordinary commercial use do not attack it. It is also resistant to the effects of water, sunlight, and weathering.

Machine Tool Builders Deal with Economic Problems

THE thirty-fourth spring meeting of the National Machine Tool Builders' Association, held at the Edgewater Beach Hotel in Chicago, May 10 to 12, had a larger attendance than any meeting of the Association for several years. Many of the problems of the Association itself were discussed, and, in addition, several important questions facing industry as a whole.

The president, Norman D. MacLeod, president of the Abrasive Machine Tool Co., Providence, R. I., in a brief address referred to the progress of the industry and the problems to be met. Herman H. Lind, general manager, outlined especially the problems created by new legislation and proposed methods of taxation. A comprehensive report on apprentice training was presented by Walter W. Tangeman, vice-president of the Cincinnati Milling Machine Co., with a view to formulating definite policies pertaining to training in the industry.

One of the most analytical, thoughtful, and inspiring addresses ever heard at an association dinner was that of Dr. Glenn Frank, president of the University of Wisconsin. This address, entitled "Business and the Abundant Life," inquired into the present tendency to substitute political force for business initiative and judgment.

Dr. Frank referred to the fact that at least four of the important nations of the world—Russia, Italy, Germany, and the United States—have each asked what, under modern circumstances, should be the relation of the state to private enterprise. The outer forms of the answers that these four nations have given differ widely, but there is in all of these new, politically experimental governments a tendency to subject private enterprise to political management and to substitute highly centralized power for broadly balanced political powers.

The speaker examined into this tendency in a most clear-cut and logical manner. He pointed out the mistakes that had been made, both by the more shortsighted business leaders and the more radical politicians. He showed how these mistakes have (1) fostered measures that seek to guarantee profits to business enterprises unable to make profits on their own account; (2) tended to fix high levels of prices, so that business could not adjust itself to changing conditions; (3) fostered measures that tend to keep alive and even extend special compensation to the weak and inefficient units in our economic life; (4) urged the adoption of measures that, intended to stop unfair competition, have come to strangle the fair competition of excellent management.

The speaker elaborated on three principles which he considered most important at the present stage in our political and business life: First, whatever happens in other countries, we must preserve ourselves as a self-governing democracy; second, we must somehow break the strangle hold of the demagogues upon mass judgment; third, we must find ways and means of utilizing, instead of sabotaging, the productive means which we have invented for providing a high standard of living for everybody.

In conclusion, the speaker said: "More goods at lower prices, not fewer goods at higher prices, is the only sane goal of an age of science, technology, and power production. To me it is incredible that in an age of so many tragic, unfilled human needs as that in which we live, we should think it necessary to set out on an attempt to increase welfare by destroying wealth or declining to create it. I think history will pass a very bitter judgment upon us if we take this road in dealing with the difficulties now confronting our farms and factories.

"The coldest of cold facts is that *scientific and technical leadership has abolished the physical necessity for poverty on this continent.* It remains for political and economic leadership to abolish the social fact of poverty, and its milder manifestation, under-consumption. Science and the machine have brought us to the threshold of a social millenium, but up to date we have lacked the wit to unlock the door. To play down our productive power while human need still stalks the streets may result in stabilization of want, rather than in stabilization of welfare."

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Automobile Production Steadily Increases

April shipments by members of the Automobile Manufacturers Association were reported as 388,165 cars and trucks. On the basis of this report, Association members shipped more vehicles in April than in any month since May, 1929. In addition, April shipments represented a 19 per cent increase over the preceding month, and a 26 per cent increase over the corresponding month last year. Factory shipments for the first four months of this year amounted to 1,212,242 units, which was not only an increase of 20 per cent over the same period last year, but was the highest for any corresponding period since 1929. The Association's figures cover the operations of all but one major producer in the United States.

Carbide-Tool Grinding Has Been Speeded Up

Drastic reductions have been made possible in the sharpening of cemented-carbide tools through a complete study of the factors involved. Tools that formerly took an hour or two to grind are now completely conditioned in a few minutes.

To inform the users of carbide tools about the latest grinding technique, the Carboloy Company, Inc., Detroit, Mich., recently conducted demonstrations in Chicago, Cleveland, Pittsburgh, and Newark, N. J. One of the tests consisted of regrinding a 5/8-inch by 1 1/4-inch tool dulled by ordinary use. The average time required to resharpen a tool of this type by the latest method was between two and three minutes, whereas with previous methods, it was between twenty and forty minutes.

Another test consisted of completely grinding all surfaces at the cutting end of "milled and brazed" tools. An ordinary tool of this type—5/8 inch by 1 1/4 inches, for example—requires from one to two hours by the previous method, whereas under the new procedure, it is completely conditioned in from 4 1/2 to 7 minutes. In the case of carbide tools chipped through accidental use, the new method has proved unusually advantageous. For instance, in one test, a 1/2- by 3/4-inch tool chipped to a depth of about 3/16 inch was completely reground in about three minutes. In the past, a tool in this condition has frequently been considered a total loss, due to the excessive amount of time required for reconditioning, and has therefore generally been scrapped.

The demonstrations emphasized the fact that the important factors in the rapid grinding of carbide tools are: (1) The proper dressing of the grinding wheels; (2) a constant motion of the tool during grinding; (3) the use of double or composite angles on the tools; and (4) alternate grinding of the carbide tip and the steel shank when it is necessary to hog off large amounts of stock, as in the case of chipped carbide tools.

When alternate grinding—first on the steel shank and then on the carbide tip—is employed in removing large amounts of stock, the steel of the shank loads up the silicon carbide wheels (made specifically for grinding carbide tools), and the carbide tip tends to dress the wheels. This makes rapid grinding possible. Aluminous-oxide wheels can be used to grind the steel shank when desired, but in that case, care must be taken to prevent the wheel from coming in contact with the carbide tip. In addition to the four important factors mentioned, of course, care must be taken to use the proper wheels, machines, and fixtures.

An Anniversary in the Welding Field

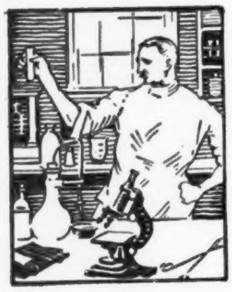
This year marks the fiftieth anniversary of the invention of resistance welding. It was in March, 1886, that Elihu Thomson applied for patents on the Thomson process of electric resistance welding. The first welder was a simple device—little more than a transformer fitted with a clamp and a pair of electrodes. While the size and type of work that could be done on it were limited, it did join metals quickly and effectively.

Two years later, Professor Thomson founded the Thomson Electric Welding Co. to develop, manufacture, and sell welding machines. The wagon and carriage industry and the bicycle plants began to make general use of the process. Today it is used in almost every industrial field. It is estimated that, because of resistance welding, it is possible to produce an automatic refrigerator, for instance, at a price from $35 to $75 less than would otherwise be feasible. Almost every metal object used in the home offers an opportunity for resistance welding. Lamps, toasters, percolators, vacuum cleaners, washing machines, radios, kitchen utensils—all have their share of electric welds, not to mention industrial equipment and appliances.

Professor Elihu Thomson and the First Transformer for Electric Resistance Welding Built by Him in 1886

To have contributed a single invention as far-reaching as this one would have been an outstanding achievement for any man, but Professor Thomson's genius did not stop there. He is responsible for hundreds of electrical devices of every possible type, and more than 700 patents in the United States alone relate to his work. Professor Thomson recently celebrated his eighty-third birthday.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

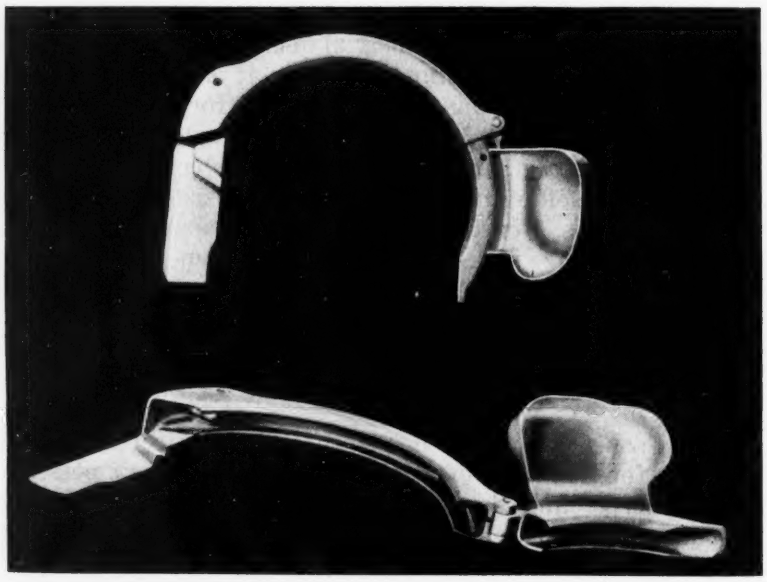
New Steel Combines High-Temperature Strength and Oxidation Resistance

A steel designated "Silmo," which is especially intended for applications requiring high-temperature strength combined with oxidation resistance, has been placed on the market by the Timken Steel & Tube Co., Canton, Ohio. This new steel can be used to replace carbon steel when greater safety is required and it is also recommended as a substitute for standard carbon-molybdenum steel where oxidizing conditions are encountered. It is suitable for use in the fabrication of cracking furnace tubes, pipe-still heater tubes, high-pressure boiler and superheater tubes, and tubing used in air heating equipment.

The chemical composition of "Silmo" steel is as follows: Carbon, 0.15 per cent maximum; manganese, 0.30 per cent maximum; phosphorus, 0.04 per cent maximum; sulphur, 0.045 per cent maximum; silicon, from 1.15 to 1.65 per cent; and molybdenum, from 0.40 to 0.60 per cent.

Tests conducted on 1-inch specimens annealed at 1550 degrees F. to a hardness reading of 146 Brinell have shown that at 85 degrees F. the ultimate tensile strength is 71,750 pounds per square inch, the yield strength, 47,600 pounds per square inch, the elongation in 2 inches, 35.3 per cent, and the reduction of area, 66.1 per cent. At a temperature of 750 degrees F., the ultimate tensile strength is 64,350 pounds per square inch, the yield strength is 25,450 pounds per square inch, the elongation in 2 inches is 35.8 per cent and the reduction of area is 69.5 per cent. At a temperature of 1100 degrees F., the ultimate tensile strength is 35,600 pounds per square inch, the yield strength, 19,250 pounds per square inch, the elongation in 2 inches is 45 per cent, and the reduction of area is 81.4 per cent. At a temperature of 1400 degrees F. the ultimate tensile strength is 9700 pounds per square inch, the yield strength is 5100 pounds per square inch, the elongation in 2 inches is 85.3 per cent, and the reduction of area, 82.5 per cent.

The Charpy impact value, when a specimen has been held at 85 degrees F. for one hour, is 35.7 foot-pounds. When a specimen has been held at 750 degrees F. for one hour, the Charpy impact value is 42 foot-pounds, and when held at the same temperature for 1000 hours, the value is 47 foot-pounds. A specimen held at 1100 degrees F. for



The knife guards for food-slicing machines have been successfully produced by die-casting. The larger curved section shown is 15 inches across. The slots, with pronounced under-cuts, are cast. These unusual castings are made in one piece by the Superior Die Casting Co., Cleveland, Ohio. They weigh about 2 1/2 pounds

one hour will have a Charpy impact value of 26 foot-pounds, and when held at the same temperature for 1000 hours, a value of 31.5 foot-pounds.

Metal Coatings Now Obtainable on Cardboard

Thin sheets of metal bonded to cardboard and other backing materials constitute a recent product of the American Nickeloid Mfg. Co., Peru, Ill. This provides a sheet having the appearance of metal, but which is largely non-metallic. The new product is known as Metal-Bord. The cement used to hold the two materials together remains plastic, so that their adherence is permanent. Low cost and light weight are the advantages claimed.

Various metals can be applied to cardboard by this process, and different metal and cardboard thicknesses can be supplied. Metal-Bord is obtainable in sheets up to 36 by 96 inches; in plain, striped, crimped, and corrugated patterns; and with a bright or satin finish. It is intended for use in constructing decorative panels, signs, advertising displays, etc., and in manufacturing buttons, buckles, and dress ornaments.

Nickel Steel Improves Efficiency of Mine Skips

The big mining companies are following the lead of the railroads in adopting lighter weight construction to reduce excess dead weight in haulage. The skips that hoist the ore out of some well-known Canadian mines have been redesigned with a liberal use of nickel steel to reduce their weight and thereby increase their carrying capacity by 1 1/2 tons per load. The steel skips used in the past weighed 15,000 pounds empty and had a hoisting capacity of 19,000 pounds of ore. The nickel-steel skips weigh 12,000 pounds and have a hoisting capacity of 22,000 pounds of ore.

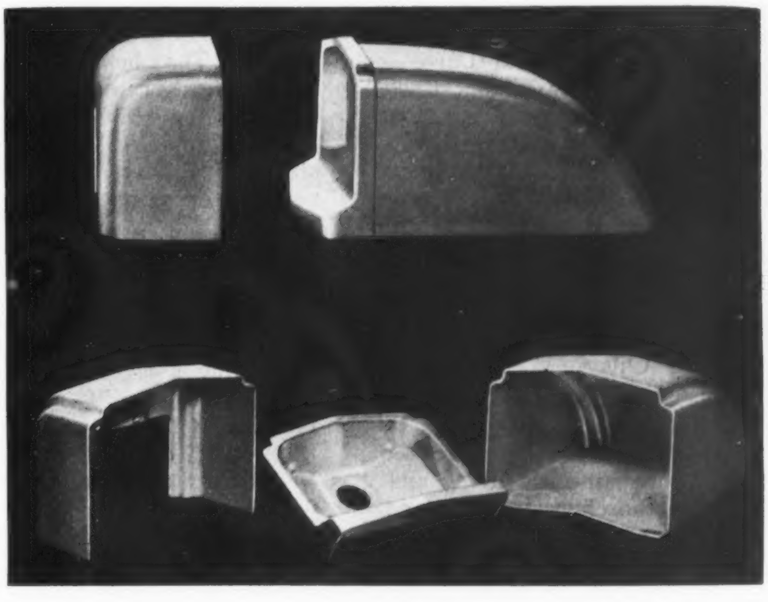
The highly stressed members, such as angles, channels, plates, bars, and other rolled sections are constructed from 3 1/2 per cent nickel steel. The forgings are made from 2 1/2 per cent nickel railway forging steel, and the steel castings are of 2 per cent nickel cast steel.

Sand-Blasting Machine Protected by Rubber

A large automatic circular sand-blasting machine which, loaded with stove castings, revolves during the sand-blasting operation, is used at the Quick Meal Stove Division of the American Stove Co., St. Louis, Mo. The bedplate of this machine consists of cast-iron grills in sixteen sections, weighing about 64 pounds each. Owing to the wear caused by the sand-blasting operation, these grills had to be replaced about every three months at a cost of $31.

In November, 1934, the grills were covered with a 3/8-inch sheet of Armorite, a product of the B. F. Goodrich Co., Akron, Ohio, which is a soft elastic rubber attached to a fabric-fiber base. This rubber compound has a tensile strength of 4000 pounds per square inch, and has a remarkable capacity for resisting wear. The Armorite covering the grills has now been in service for over eighteen months, and has shown no appreciable signs of wear. The company has made a saving so far of $123 in grill replacements, equivalent to three times the investment in the rubber sheets.

Over a year ago the company equipped a rectangular sand-blasting machine in a like manner, placing a 3/8-inch sheet of Armorite on the bedplate and also suspending 1/8-inch thick sheets like curtains along the back and end walls. This installation has been operated over a year without wear.



Zinc-base alloy die-cast water-cooler parts constitute a new application of die-castings. The basin has a maximum inside depth of 9 inches by 6 1/2 inches wide. These castings, as produced by the Superior Die Casting Co., Cleveland, Ohio, are made with extremely thin walls, in order to provide minimum weight for a large piece

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Carboloy Tools

CARBOLOY COMPANY, INC., 2985 E. Jefferson Ave., Detroit, Mich. Catalogue entitled, "The Profitable Use of Carboloy Cemented Carbides," covering the advantages of Carboloy tools; operations for which these tools are suited; types of tools tipped with Carboloy; materials that can be profitably machined with these tools; size of plant that can profitably employ Carboloy tools; physical characteristics of Carboloy; applications of the different grades; the grinding of Carboloy tools; operation and design recommendations; and method of making Carboloy tools.

Indicating, Controlling and Recording Equipment

BROWN INSTRUMENT CO., Wayne and Roberts Aves., Philadelphia, Pa. Circular illustrating and briefly describing the part indicating, controlling, and recording instruments play in the modern industrial plant. Catalogue entitled "Instruments from the Executive Viewpoint," showing how the instruments made by this concern make it possible to decrease costs in industrial plants. A few of the many applications of these instruments are illustrated.

Carboloy Products

HENRY DISSTON & SONS, INC., 606 Tacony, Philadelphia, Pa. Booklet entitled "Disston Carboloy Products —Their Selection and Care," containing information about Carboloy and how Carboloy is fitted to saws, knives, and other cutting tools. The booklet also contains recommendations for the application of Carboloy-fitted saws and instructions for the care and maintenance of these saws, with complete information on grinding Carboloy.

Cutting Oils

SULFLO CORPORATION OF AMERICA, 701 Spring St., Elizabeth, N. J. Booklet outlining the principles of lubrication in metal-cutting and describing the characteristics and applications of a new cutting oil known as "Sulflo." The booklet also contains directions for using this cutting oil so as to obtain the most satisfactory results, including the preparation of the machine for the use of Sulflo, effect of tool form, etc.

Precision Gage-Blocks

JOHANSSON DIVISION OF THE FORD MOTOR CO., Dearborn, Mich. Circular giving the sizes of Johansson gage-blocks in set No. 1, which consists of eighty-one blocks by means of which 120,000 different sized gages in steps of 0.0001 inch can be made, ranging from the minimum size of 0.200 inch to over 12 inches. Some of the accessories used with the gage-blocks are also illustrated.

Electric Motor Bearings

JOHNSON BRONZE CO., S. Mill St., New Castle, Pa. Catalogue EM-6, featuring the complete line of electric motor service bearings made by this company for different types of motors. The bushings are listed alphabetically according to the make of motor for which they are intended, and numerical and progressive size listings are included for convenient reference.

Lubricating Oils

CONTINENTAL OIL CO., Ponca City, Okla. Booklet entitled "Regimentation Agents in Lubricating Oils," containing a reprint of two papers on lubricating oils read before a meeting of the American Petroleum Institute. One paper is entitled "Fundamental Chemical and Physical Forces in Lubrication," and the other, "Practical Selection of Improved Lubricants."

Heat-Treating Furnaces and Refractories

STANDARD FUEL ENGINEERING CO., 667 S. Post Ave., Detroit, Mich. Handbook of Refractories (Bulletin 37), containing information on refractory cements, refractories, and heat-treating and other furnaces. The book also contains much tabular material of interest to those whose use of refractory materials requires specific formulas.

Welded-Steel Tubing

STEEL & TUBES, INC., 224 E. 131st St., Cleveland, Ohio. Handbook on welded-steel tubing, published under the supervision of the Formed Steel Tube Institute. The purpose of this handbook is to give the user a thorough knowledge of the application of welded-steel tubing; its physical, chemical, and metallurgical properties; and commercial tolerance limitations.

Sawing, Polishing, and Filing Machines

CONTINENTAL MACHINE SPECIALTIES, INC., 1301 S. Washington Ave., Minneapolis, Minn., is distributing a monthly publication entitled "The Do-All Digest." This publication describes features of this company's "Do-All" sawing, filing, and polishing machines, as well as interesting applications made by users.

Gears and Speed Reducers

OHIO GEAR CO., 1333 E. 179th St., Cleveland, Ohio. New 128-page catalogue, describing the complete line of spur, bevel, worm, and other gears, as well as motorized speed reducers, manufactured by this company. The catalogue also includes technical data on gearing and information on S A E standard heat-treatment methods.

Saws and Tools

PITTSBURGH TOOL-KNIFE & MFG. CO., 7501 Thomas Blvd., Pittsburgh, Pa. Catalogue C, illustrating and describing a complete line of solid and inserted-tooth metal-cutting circular saw blades, circular saw grinders, cut-off machines, shear

blades, knives, rivet sets, pneumatic hammer chisels, bushings, punches and dies, etc.

Welding Equipment

LINDE AIR PRODUCTS Co., 30 E. 42nd St., New York City. Booklet giving information on the welding and cutting of high-chromium steels by the oxy-acetylene process. The effect of chromium on welding procedures is discussed, and various techniques for welding the different types of high-chromium steels are recommended.

Portable Grinding Equipment

NORTON Co., Worcester, Mass. Booklet entitled "Grinding and Finishing with Portable Equipment," showing many different examples of the application of Norton portable grinding equipment in various industries. The booklet also gives grain and grade recommendations for grinding different kinds of materials.

Drop-Forgings

J. H. WILLIAMS & Co., 420 Vulcan St., Buffalo, N. Y. Folder containing much useful information for buyers and users of drop-forgings, including a table of weights of metals, die draft equivalents, and data on accepted drop-forging practice which should be of value to draftsmen and designers in laying out drop-forged parts.

Magnetic Pulleys and Separators

DINGS MAGNETIC SEPARATOR Co., Milwaukee, Wis. Catalogue 25, dealing primarily with magnetic pulleys and pulley type separators. In addition to the data on the pulley type separators, information is included on magnetic separators of other designs, both standard and special.

Needle Bearings

TORRINGTON Co., 55 Field St., Torrington, Conn. Catalogue on Torrington needle bearings, outlining the advantages of these bearings, and listing specifications and tolerances. A table of rated radial load capacities, and information on lubrication, manufacturing tolerances, and installation are included.

Castings

AMERICAN BRAKE SHOE & FOUNDRY Co., 230 Park Ave., New York City. Catalogue 36, listing the products of this company and its subsidiaries, which include brake-shoes, miscellaneous iron castings, special alloy castings, heat-resisting and abrasion-resisting castings, and armored concrete.

Precision Tools

WEBBER GAGE Co., 2517 Vestry Ave., Cleveland, Ohio. Catalogue covering the line of precision tools made by this concern, which includes comparators and precision gage-blocks. These tools are supplied as one precision size control unit in a substantial case with an extra drawer for accessories.

Rebuilt Machinery

J. L. LUCAS & SON, INC., 3 Fox St., Bridgeport, Conn. List No. 85, covering the complete stock of rebuilt machines offered by this company, which includes all the standard types of machine tools, as well as miscellaneous and special machinery. Illustrations of the machines are included in many cases.

Cold-Finished Steel Bars

UNION DRAWN STEEL Co., Massillon, Ohio. Booklet describing the following cold-finished steel products: Cold-drawn carbon and alloy steel bars; Bessemer screw steel; Union high-manganese screw steel; cold-finished Enduro stainless steel; cold-finished shafting; and cold-drawn special sections.

Bench Millers

PRATT & WHITNEY Co., Hartford, Conn. Circular 422, illustrating and describing the Pratt & Whitney No. 3 universal bench miller which has all the features and capabilities of the floor type machines. The illustrations show applications of this machine on various classes of work.

Multiple-Spindle Tapping Heads

ETTCO TOOL Co., 596 Johnson Ave., Brooklyn, N. Y. Bulletin 3, illustrating and describing the construction and special features of the Ettco-Emrick multiple-spindle tapping heads for small taps. Price lists for the various sizes are included.

Industrial Trucks

BAKER INDUSTRIAL TRUCK DIVISION OF THE BAKER-RAULANG Co., 2168 W. 25th St., Cleveland, Ohio. Bulletin entitled "Baker Trucks in the Mechanical Industries," showing these trucks applied to a wide range of materials-handling problems.

Lathes

LODGE & SHIPLEY MACHINE TOOL Co., Cincinnati, Ohio. Catalogue 456-B, describing the construction and special features of the larger sizes of Lodge & Shipley lathes, ranging from 18 to 36 inches. Large-scale illustrations are used to make the construction clear.

Portable Electric Tools

CHARLES L. JARVIS Co., Gildersleeve, Conn. Catalogue covering the Biax line of portable electric tools, including high-speed tapping devices, floor and overhead trolley units, flexible grinders, rotary files, flexible shafts, screwdrivers and nut-setters, chucks, etc.

Precision Machines

EX-CELL-O AIRCRAFT & TOOL CORPORATION, 1200 Oakman Blvd., Detroit, Mich. Catalogue on Ex-Cell-O precision products, covering precision thread-grinding machines, boring machines, carbide tool grinders, hydraulic power units, and special multiple equipment.

Lift-Trucks

BARRETT-CRAVENS Co., 3255 W. 30th St., Chicago, Ill. Bulletin 112, entitled "Barrett Lift-Trucks Will Prove Their Superiority in Service," containing numerous illustrations showing applications of Barrett "Red Head" lift-trucks in a wide variety of industries.

Electric Control Apparatus

FURNAS ELECTRIC Co., 811 S. 72nd St., West Allis, Wis. Catalogue 36, containing data, including price lists, covering the line of electric drum controllers made by this company. Several new products not previously described are included in this catalogue.

Die Coating and Mold Dressing

ST. JOHN X-RAY SERVICE, INC., 30-20 Thomson Ave., Long Island City, N. Y. Circulars giving information, including prices, on Bonis die coating and mold dressing for non-ferrous die and permanent mold castings.

Indicating, Recording and Controlling Instruments

BRISTOL Co., Waterbury, Conn. Bulletin 440, illustrating and describing the Bristol Ampliset free-vane electric controller for tempera-

ture, time-temperature, flow, liquid level, pressure, time-pressure, and humidity.

Electric Motors

OHIO ELECTRIC MFG. CO., 5900 Maurice Ave., Cleveland, Ohio. Bulletin entitled "Why Ohio Motors are Reliable," illustrating some of the special procedures and tests made in building Ohio fractional-horsepower motors, to insure efficiency and reliability.

Grinding Wheels

CHICAGO WHEEL & MFG. CO., 1101 W. Monroe St., Chicago, Ill. Catalogue on the various types of grinding wheels made by this company, including straight wheels, cylinder wheels, cup-wheels and special wheels. Prices are included.

Sanding Drums and Abrasive Sleeves

R. G. HASKINS CO., 4634 W. Fulton St., Chicago, Ill. Folder giving detailed information on sanding drums, abrasive sleeves, and accessories for use with flexible shaft equipment. Price lists are included.

Pipe Welding Fittings

BONNEY FORGE & TOOL WORKS, Allentown, Pa. Bulletin WT21, descriptive of Bonney Weldolets and Thredolets—stock pipe welding fittings specifically designed to make branch connections, such as tees, crosses, side outlets, etc., by welding.

Lubrication

PYROIL CO., 105 LaFollette Ave., LaCrosse, Wis. Monthly publication entitled "The Pyroil News," containing data on the uses and application of Pyroil for lubrication purposes, and interesting information pertaining to the manufacture of Pyroil.

Measuring Wires

VAN KEUREN CO., 12 Copeland St., Watertown, Mass. Circular W-34, covering specifications for measuring wires and methods of measuring and using wires as recommended by the 1933 report of the National Screw Thread Commission.

Alkali Cleaning Compounds

DETROIT REX PRODUCTS CO., 13005 Hillview Ave., Detroit, Mich. Four-page folder describing applications of "Triad" alkali cleaning compounds. The circular also points out the advantages of the Detroit Rex metal cleaning service.

Collapsible Taps

LANDIS MACHINE CO., INC., Waynesboro, Pa. Bulletin G-81-1, illustrating two styles of Landis collapsible taps for cutting straight threads and tapered threads, respectively. Brief information on sizes and special features is included.

Saw-Sharpening Machines and Tools

WARDWELL MFG. CO., 3167 Fulton Road, Cleveland, Ohio. Catalogue 36, illustrating this company's line of machines for automatically sharpening various kinds of saws used for cutting wood or metal.

Seamless Tubing

PARKER APPLIANCE CO., 17325 Euclid Ave., Cleveland, Ohio. Bulletin 41, containing technical data and price lists covering Parker seamless tubing, in copper, aluminum, carbon steel, stainless steel, Monel metal, and nickel.

Hydraulic Valves

W. H. NICHOLSON & CO., 12 Oregon St., Wilkes-Barre, Pa. Circular describing the construction and operation of Nicholson hydraulic two-, three-, and four-way type valves for oil or water service up to 5000 pounds pressure.

Electric Hoists

HARNISCHFEGER CORPORATION, 4536 W. National Ave., Milwaukee, Wis. Bulletin H-1, devoted to the construction, installation, and operation of the "Zip-Lift" hoist, a new light hoist made in 250- and 500-pound capacities.

Milling Machines

U. S. TOOL CO., INC., Ampere, N. J. Folder describing the details of construction and operation of the U. S. Multi-Miller, which is designed for high-speed production runs, as well as for general hand milling work.

Zinc-Base Die-Cast Alloys

APEX SMELTING CO., 2554 Fillmore St., Chicago, Ill. Metalgram No. 9, containing charts showing the impact strength of No. 3 zinc-base die-cast alloy when cast at different metal and die temperatures and pressures.

Woodworking Machines

B. M. ROOT CO., York, Pa. General catalogue No. 84, covering this company's line of woodworking machines, including multiple- and single-spindle borers, boring heads, metal drilling heads, etc.

Time and Magnetic Switches

ZENITH ELECTRIC CO., INC., 607 S. Dearborn St., Chicago, Ill. Bulletins 500, 720, 780, 780B, and 780C, containing specifications, including prices, of the line of time switches and magnetic switches made by this company.

Inserted-Blade Milling Cutters

INGERSOLL MILLING MACHINE CO., Rockford, Ill. Leaflet illustrating and describing Ingersoll "Tri-Lock" triple-serrated blade cutters for machining narrow keyways or slots. Price lists are included.

Electric Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Application Sheet No. 48, containing information of value to the designer on the strength of welded joints and methods of estimating weld dimensions.

Electric Motors

RELIANCE ELECTRIC & ENGINEERING CO., 1042 Ivanhoe Road, Cleveland, Ohio. Bulletin 117, illustrating and describing wound-rotor motors for two- and three-phase alternating current.

Variable-Speed Devices

NEW DEPARTURE MFG. CO., Bristol, Conn. Leaflet entitled "Now! a Million Speeds at the Touch of a Finger," outlining the features of the New Departure variable-speed "Transitorq."

Diesel Engines

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Catalogue S-500-B29, containing data covering the construction of Worthington vertical four-cycle Diesel engines.

Die-Heads

EASTERN MACHINE SCREW CORPORATION, 23-43 Barclay St., New Haven, Conn. Bulletin illustrating and describing the Style TM insert-chaser die-head for cutting tapered threads.

Industrial Trucks

LEWIS-SHEPARD CO., 246 Walnut St., Watertown (Boston), Mass. Circular 217, illustrating different styles of industrial wagon trucks for handling products within a plant.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Oilgear 100-Ton Horizontal Swaging Press with Indexing Dies

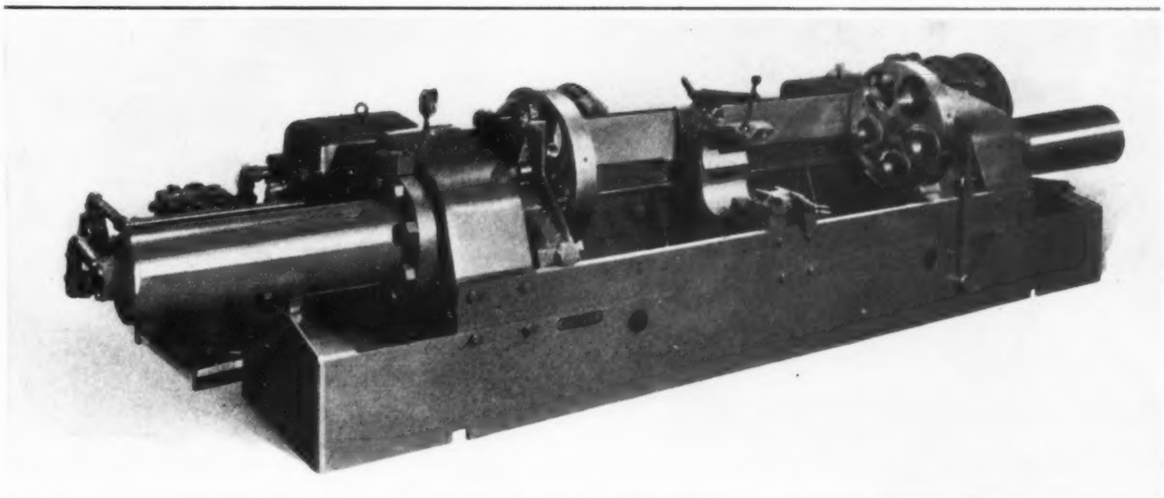
Both ends of large steel tubes used for motor-truck rear-axle housings are cold-swaged simultaneously from a diameter of 6 inches to 4 inches by a 100-ton horizontal press recently designed and built by the Oilgear Co., 1310 W. Bruce St., Milwaukee, Wis. The operation is performed by using five swaging dies of different sizes in each of two indexing rotary type heads or supports at the opposite ends of the machine base. The operation is completed with five passes of the swaging dies to and from the work.

The rear-axle housing tube is first located in the center stationary fixture and then clamped manually. The dies in the opposing five-station rotary type supports are moved forward by means of the cross-heads for swaging both ends of the tube at the same time, and returned by the cross-heads as each swaging step is completed.

The indexing of each die support is effected manually, independently of the other. As each die reaches the lowest position, it is in line with the center of the corresponding cylinder ram, in position for swaging. One hand-lever at the front of the press controls both the speed of the two cross-heads and the direction in which they are moved.

Separate variable-delivery pumps mounted on independent bases operate the cross-heads. These pumps are driven by 50-horsepower electric motors that run at 860 revolutions per minute. The base of the machine is a one-piece welded-steel structure. It supports the two cylinders, yokes, cross-heads, and center clamping fixture, as well as two large rectangular tie-bars constructed of steel, which are bolted to the yokes to carry the tension load of the opposing rams. Each cylinder is double-acting and its ram is guided in a large bronze liner. Rollers that ride on the tie-bars carry the cross-heads and the five-station rotary type die supports.

Each cylinder in this machine has a capacity of 100 tons, and the stroke of each piston is 40 inches. The maximum distance between the die-blocks is 96 inches. The maximum pushing speed is 135 inches a minute, while the maximum return speed is 300 inches a minute. The weight of this machine, equipped with the pumps, is approximately 32,000 pounds.



Oilgear Swaging Press Designed for Forming Long Tubes into Motor-truck Rear-axle Housings

"Hole Wizard" Radial Drilling Machines

Higher speeds, lower drilling costs, less operating effort, and lower maintenance costs are advantages claimed for the "Hole Wizard" radial drilling machine, brought out by the American Tool Works Co., Cincinnati, Ohio. This machine is made in nine- and twelve-speed types, with 3- and 4-foot arms. The twelve-speed machine has a five-horsepower built-in motor and a capacity for tapping and drilling holes up to 2 inches in diameter in cast iron and 1 1/2 inches in steel. The twelve spindle speeds in geometrical progression cover a range of 50 to 1500 revolutions per minute. Pick-off gears may be used to change the range of speeds to suit requirements.

Reversal of the spindle for tapping can be obtained almost instantaneously by reversing the motor, only approximately 2 1/2 seconds being required to change from full forward to full reverse speed. A small lever located directly below the speed control levers provides control for starting, stopping, and reversing.

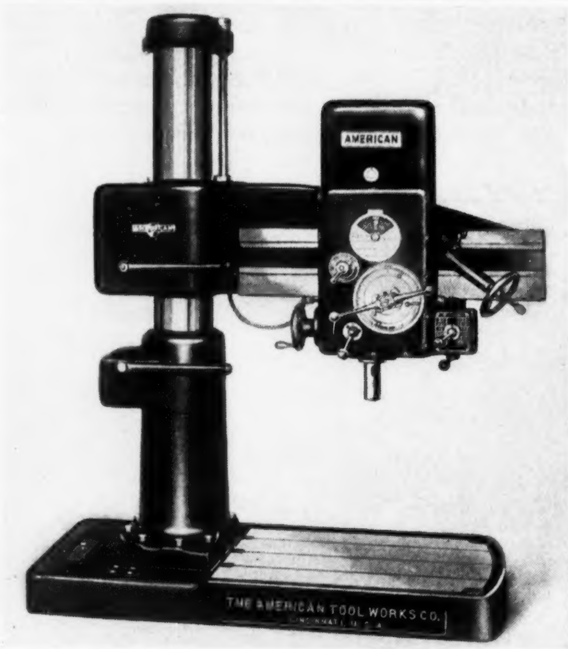
The spindle is ground its entire length to a close sliding fit in the sleeve. The spindle sleeve is hardened, honed to size, and mounted in Timken roller bearings. The drive is through hardened and ground helical gears. Six rates of power feed are provided ranging from 0.004 to 0.025 inch per revolution of the spindle. An automatic feed-trip is provided which operates up to 12 inches at one setting. Power elevating and lowering of the arm is accomplished by means of a small 3/4-horsepower motor built into the rear of the arm.

The nine-speed machine is equipped with a three-horsepower built-in motor and has a capacity for drilling and tapping holes up to approximately 1 1/4 inches in diameter in cast iron and 3/4 inch in steel. The nine spindle speeds, arranged in geometrical progression, cover a range of 70 to 1500 revolutions per minute. Pick-off gears may be used to change this range to suit requirements. Four rates of geared power feed are provided ranging from 0.004 to 0.020 inch per revolution of the spindle. The automatic feed-trip operates up to 10 inches at one setting. The constructional and operating features of this machine are practically identical with those of the twelve-speed machine previously described.

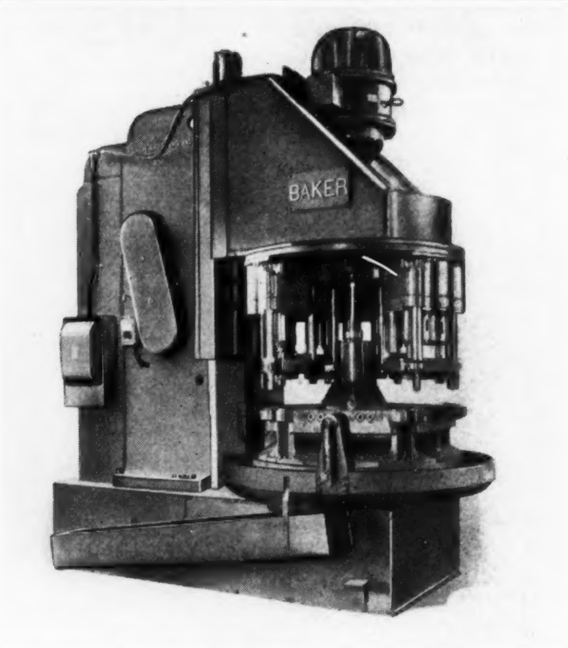
Baker Five-Station Drilling, Reaming, and Counterboring Machine

Baker Bros., Inc., Toledo, Ohio, have recently built the hydraulically operated machine here illustrated for core-drilling and reaming two holes in tractor links and also rough- and finish-counterboring a large hole in the same parts. One right-hand link and one left-hand link are produced with every indexing of the machine.

The construction features of this equipment include 30-inch wide ways, an unusually long saddle, and a large overhanging head. The operating cycle includes a double feed, a delayed reverse, a coarse boring feed



"Hole Wizard" Radial Drilling Machine Built by American Tool Works Co.



Baker Hydraulically Operated Drilling, Reaming, and Counterboring Machine

with an automatic change to a fine feed for facing, and a positive stop with a dwell of several revolutions before tripping, to insure squarely faced surfaces. The feeding and traverse movements are obtained through the use of an Oilgear pump.

Hannifin "Hy-Power" Hydraulic Riveter

A "Hy-Power" duplex riveter designed especially for an assembling operation on axle housings has been developed by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill. This machine heads two rivets simultaneously at the rate of 1800 rivets an hour, and is one of several types developed for individual production requirements, other models being made in both portable and stationary types for heading either larger or smaller rivets. A fast operating cycle of 2 1/2 seconds, low power consumption, and a work-holding fixture that permits rapid handling of the work are special features.

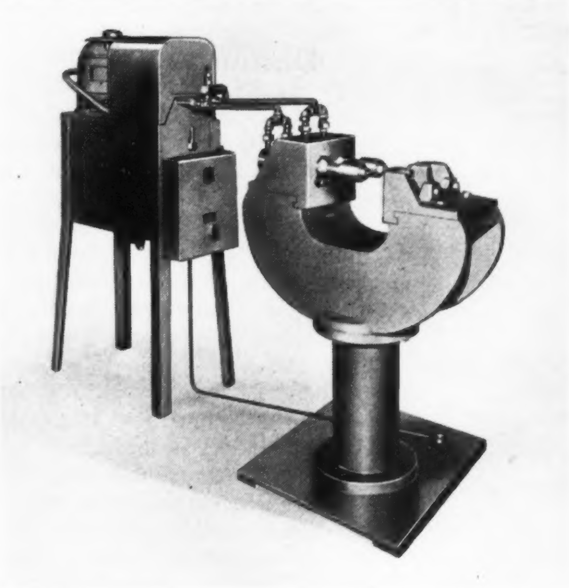
The duplex hydraulic rams are actuated by a new type of pressure generator unit, driven by a two-horsepower motor and equipped with automatic electrically operated control valves. Simply touching the push-button of the foot-operated switch actuates the hydraulic unit and automatic valve, causing the riveting cycle to be completed automatically.

The cycle of the hydraulic ram comprises a rapid advance stroke at moderate pressure until the die touches the rivet; application of high pressure which heads the rivet; reversal at the peak pressure; and rapid return to the starting position. After completing the cycle, the oil-pump idles at zero pressure until the next operating cycle. The riveter ram of the machine shown develops 35,000 pounds pressure, which is ample for heading 3/8-inch cold rivets. The same amount of pressure is applied to both rivets, regardless of their length.

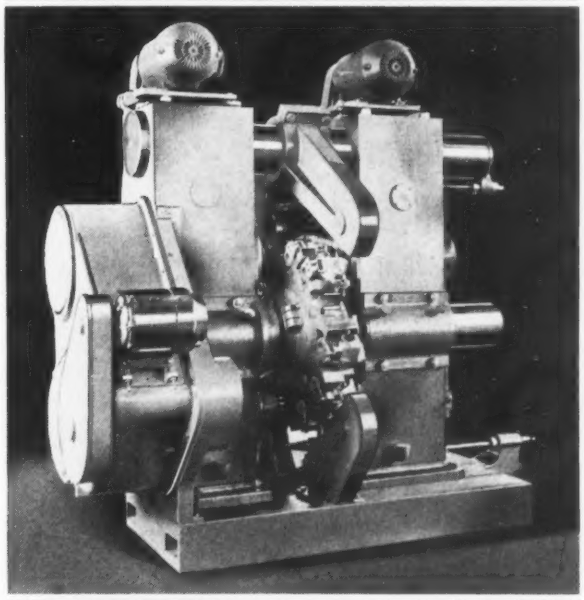
Davis & Thompson Drum Type Milling Machine with Adjustable Head

A No. 2-A milling machine with two opposed milling heads, each equipped with a roughing and a finishing spindle, has been brought out by the Davis & Thompson Co., 6619 W. Mitchell St., Milwaukee, Wis. The right-hand head can be adjusted on the machine base to take work of any length within the capacity of the machine. The finishing spindles can be adjusted for toe and heel cuts while the machine is in operation. Pick-off gears are provided for obtaining changes in feed and speed.

The illustration shows one of the smaller machines of the new line. This machine is arranged to mill the top and bottom of air-cooled cylinders. The operator simply places the pieces in the fixture and pulls the levers down to hold the work until it passes under the chain of the chain-clamping device which holds the parts while they are being milled. After a fixture has completed its cycle, the operator reverses the lever and removes the milled piece. An experienced operator can produce 145 pieces



Hannifin Hydraulic Riveter Designed for Assembling Operation on Rear Axles



Adjustable-head Drum Type Milling Machine Built by the Davis & Thompson Co.

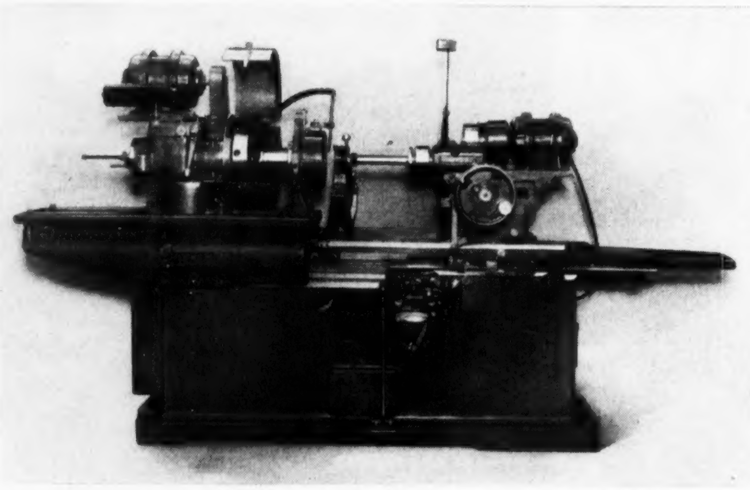
an hour. This production is materially increased as the operator becomes accustomed to the work. The machine is made in different sizes to accommodate a wide variety of parts.

Heald Internal Grinder Equipped for Grinding Long Holes

To meet the demand for an internal grinder that will handle work with very long holes, as well as the general run of internal grinding, the Heald Machine Co., Worcester, Mass., has developed the "Long Bridge" No. 72A internal grinder shown in the illustration. This grinder can be furnished either as a plain or an automatic machine and with a standard or long base, as desired.

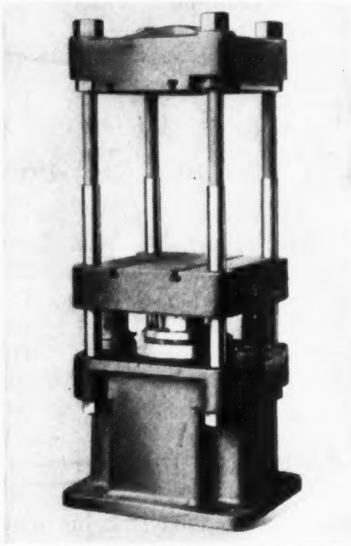
It is similar to the standard Heald No. 72A internal grinder, with the exception that it is equipped with a long work-head bridge and steadyrest. The machine will grind holes up to 30 inches long. When the hole is over 15 inches deep, however, it is necessary to grind from one end and then turn the part around and grind from the other end.

Machines like the one shown are used by machine tool builders for grinding the noses of spindles for both milling and drilling machines, as well as other products. This machine is also adapted for grinding the bores of long hydraulic strut cylinders for airplanes. Practically all types of cylinders, tubes, headstocks, sleeves, and struts, as well as the regular run of internal grinding, can be handled on this machine.



Heald Grinder Equipped with Long Work-head Bridge and Steadyrest

Defiance Hydraulic Plastic Molding Press



Defiance Hydraulic Press for Molding Plastic Materials

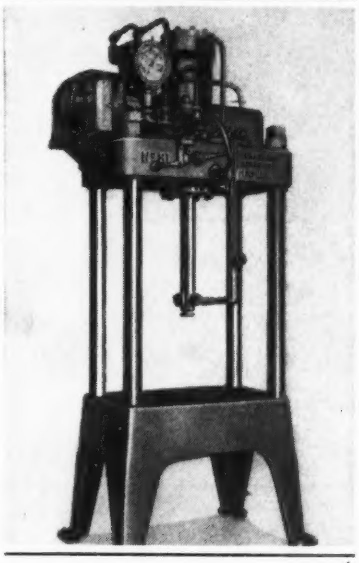
A four-column hydraulic molding press with a capacity of 75 to 100 tons has been built by the Defiance Machine Works, Defiance, Ohio, especially for molding plastic materials, rubber, and similar products. This press is fitted with a main hydraulic cylinder which has a 9-inch-diameter ram that imparts a 12-inch stroke to the lower platen. Pull-back cylinders for returning the lower platen have 2 1/4-inch bores and provide 13-inch strokes. The main cylinder is mounted in the base, while the pull-back cylinders are mounted on each side.

The upper and lower platens are both 26 by 24 1/2 inches. T-slots run from front to back for attaching the molds. The upper platen is adjustable to provide an opening from 12 to 24 inches between the platens. The upper platen is mounted on the four columns which are bolted to the base. The lower platen is fitted with bronze bushings to slide on the columns. The space between the columns measures 18 by 16 1/2 inches.

Disston "Nu-Mol" Hacksaw Blades

General-purpose hacksaw blades for hand and power use, which are claimed to be tougher, stronger, and more economical than the ordinary carbon and molybdenum blades have been developed by Henry Disston & Sons, Inc., 606 Tacony, Philadelphia, Pa.

These new blades, which are known as "Nu-Mol," are especially adapted for hand use under conditions where they are subjected to extreme abuse, and for power use in cutting small stock that is stacked and bundled. They are made in standard lengths, widths, and thicknesses, and with standard numbers of teeth.



Greenerd Hydraulic Press Brought out by the Edwin E. Bartlett Co.

Greenerd Hydraulic Press

A self-contained hydraulic press which can be adjusted to give any desired pressure up to 15 tons on the down stroke and 13 tons on the up stroke has been brought out by the Edwin E. Bartlett Co., Nashua, N. H. This press, known as the No. 81 Greenerd, is suited for various applications. It is particularly adapted for light plastic molding requiring pressures up to 15 tons on the down stroke. This pressure can be held until the plastic material sets and then released with a 13-ton pull for opening the mold. The press can be quickly adjusted to give the pressure required for different kinds of work.

A combination low- and high-pressure Vickers pump driven by a three-horsepower motor mounted on the side of the head that contains the tank comprises the hydraulic equipment. The control valve is either foot- or hand-operated. Automatic or manual reversal of the arbor can be accomplished at any point. A stop-rod regulates the length of travel in either direction. When the ram is at the top position, the pump by-passes the fluid, relieving the system from pressure.

The working surface of the base within the uprights is 18 by 24 inches, and the clearance over the table is from 17 to 30 inches as specified. The length of stroke is 17 inches.

Grinder for End-Mills and Reamers

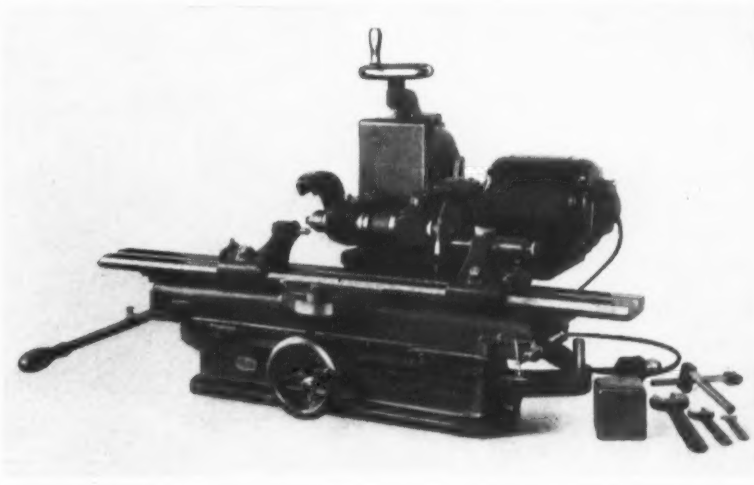
A tool grinder for sharpening straight or tapered end-mills and reamers with either straight or spiral flutes has been brought out by the Union Twist Drill Co., Athol, Mass. This tool grinder, designated No. 1, has a maximum capacity of 21 inches between centers and a maximum distance between the wheel and center of 8 inches. It will grind cutters up to 3 inches in diameter. The hardened and ground steel spindle runs in bronze boxes which are adjustable for wear. A wheel can be mounted on either end of the shaft.

The wheel-spindle slide has a vertical adjustment of 1/2 inch above or below the center line of the work. It has a traverse movement of 2 1/2 inches and is operated by a handwheel at the front of the machine. The table runs on roller bearings; it is graduated to swivel 10 degrees either way for tapered work, and can be swiveled 30 degrees either way, where the travel is short, to permit chamfering corners. The table can be quickly transferred from one end of the base to the other for grinding right- and left-hand cutters.

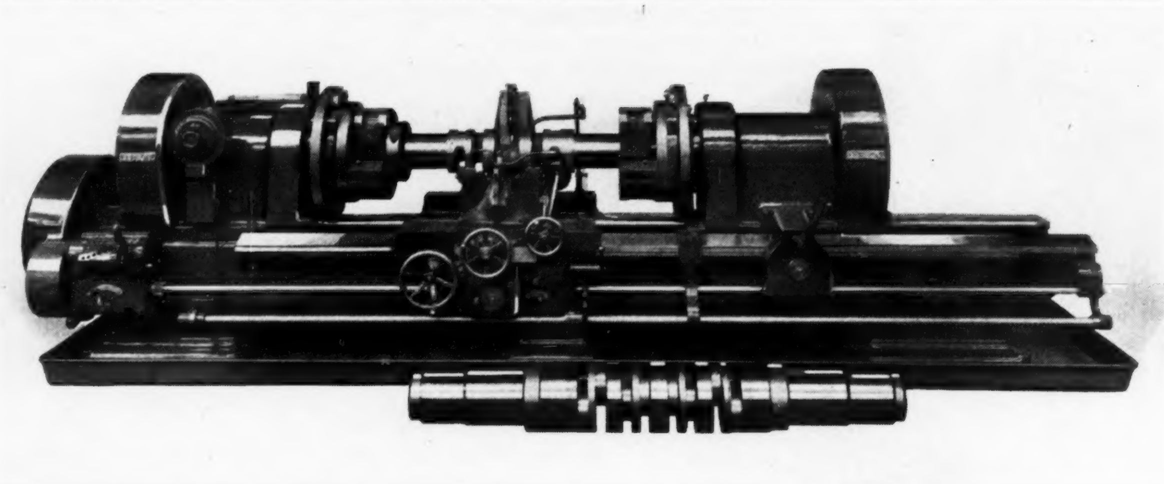
This machine takes a 4- by 1/4- by 1/2-inch grinding wheel which is driven by a 1/3-horsepower motor having a speed of 3600 revolutions per minute. The motor operates on 110-volt, 60-cycle alternating current. The equipment includes the motor and belt, the diamond-holder, two rests for straight or spiral work, and the necessary wrenches.

Ross Solenoid-Controlled Air Valve

A solenoid-controlled straight-way air valve of heavy construction, designed to withstand severe service in production plants, has been brought out by the Ross Operating Valve Co., Detroit, Mich. This valve is adapted for controlling the movement of pistons in cylinders of pneumatically operated welding machines. It can also be used as a by-pass in controlling or regulating the pressure in a cylinder. Other applications include the maintenance of constant fluid levels in tanks in connection with floats, and the remote control of air whistles.



Tool Grinder Brought out by the Union Twist Drill Co.



Le Blond Crankshaft Lathe for Diesel-engine and Other Heavy Crankshafts

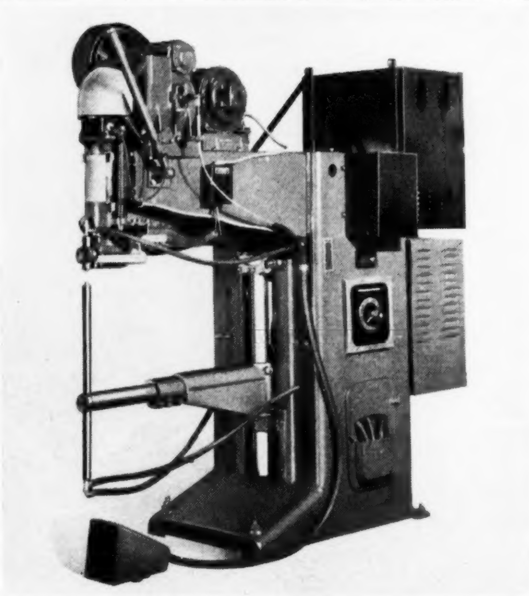
LeBlond 30-Inch Universal Crankshaft Lathe

A heavy-duty universal crankshaft lathe for turning Diesel-engine and other heavy-duty crankshafts has been developed by the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio. This lathe will handle a wide variety of crankshafts, and is adjustable for throws up to 3 1/2 inches. It can be indexed for two, three, four, six, or twelve positions. Counterweights are provided to compensate for off-balance weights of the fixture and crank. The drive from the variable-speed motor is through V-belts to a powerful multiple-disk clutch. A disk brake built into the same unit stops the spindle instantly when the clutch is released.

Both the headstock and tailstock fixtures are driven from the same spline shaft. This shaft passes through the center of the machine bed, driving the fixtures through heavy-duty face gears. A smooth, powerful drive is applied to both ends of the crankshaft by this arrangement, which eliminates any possibility of springing the crank out of line. A compensating coupling on the drive-shaft permits realigning the headstock and tailstock fixtures to take up any wear in the driving gears that may result from long continuous service. The tailstock fixture can be adjusted to accommodate crankshafts of different lengths. The roller back-rest moves in a guide at the rear of the carriage cross-slide, and can be moved into position on the bridge by a handwheel on the carriage.

Spot-Welder for Corrosion-Resisting Plates

A resistance welder designed to weld two thicknesses of 3/16-inch corrosion-resisting steel plates at a production rate of thirty to forty spots per minute, which is now being used in one of the large Navy Yards on ship construction work, has been developed by the Thomson-Gibb Electric Welding Co., Lynn, Mass. An important feature of this machine is the special split type head, which is equipped with a hand-lever, so that the upper electrode can be accurately located on the work before the power-driven, mechanically operated pressure device goes into action. This feature also provides for making spot-welds on somewhat lighter material by operating the upper head manually.



Thomson-Gibb Welder which makes from 30 to 40 Spots per Minute

A push-button is mounted at the end of

the hand-lever, so that both pressure and current can be controlled by the same hand. The lower arm is adjustable to a range of 24 inches. The equipment includes a 150 kilovolt-ampere capacity welding transformer, an auto transformer, two seven-point regulator switches, and an automatically adjustable timing device. When used in combination, the regulator switches provide forty-nine points of welding voltage and current regulation.

New Westinghouse Motors

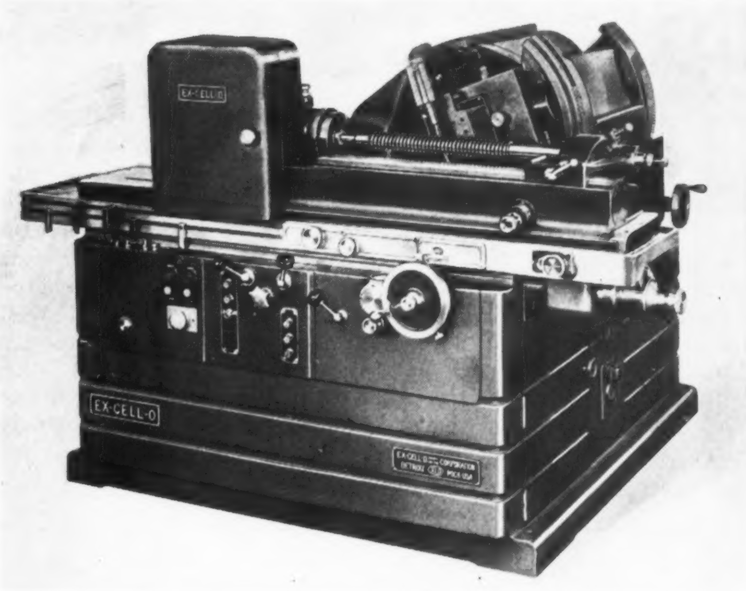
A new line of fan-cooled totally enclosed direct-current motors has been brought out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These motors are designed for general industrial service, particularly in automobile factories, machine shops, foundries, steel mills, and other industrial plants where abrasive and metallic dust is present or where splashing liquids and mild chemicals are encountered. The sizes of the new motors range from 5 to 75 horsepower for 115, 230, and 550 volts direct current. They are so built that all foreign matter is excluded from the motor, yet by removing only one cover, access to the interior is gained.

The company has also brought out a single-phase repulsion-start induction motor especially designed for heavy industrial duty, as for machine tools, pumps, and compressors. This motor is known as the CR type. It starts as a repulsion motor, and because of the high torque developed, rapidly overcomes the relatively high inertia load to which this type of motor is usually subjected, coming up to speed in a very short time. At approximately 60 per cent of synchronous speed, the armature is short-circuited by a centrifugally operated device, and the motor continues to operate as a squirrel-cage induction motor. The motor is available in ratings of from 3/4 to 3 horsepower.

Ex-Cell-O Precision Thread Grinder

A universal precision thread grinder having a capacity for grinding external threads 8 inches in diameter and 24 inches long on a piece of work 33 inches long between centers has been brought out by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. This machine is also adapted for grinding internal threads not smaller than 1 inch in diameter and 1 inch long up to 8 inches in diameter by 3 inches long. The U. S. standard form, sharp vee, and 29-degree Acme threads can be ground. Modified buttress threads with single, double, triple, quadruple, or sextuple threads ranging from 1 to 40 pitch can also be ground on this machine. A lead tolerance of 0.0002 inch per inch of thread can be maintained when grinding U. S. standard form threads.

All grinding operations are performed automatically, except for loading and unloading the work and withdrawing the grinding wheel at the end of the cut. The machine will grind to a predetermined size setting and then automatically stop feeding; or it may be set so that the table will stop at either end or any point of its travel. The rapid approach speed of the work to the grinding wheel in either direction of spindle rotation or table travel can be adjusted. Individual spindle-speed adjustments are provided for each direction of table travel or spindle rotation, and are used as work-speed adjustments for controlling the speed of the work while grinding. A lead compensating device corrects the lead error caused by taper settings. A hydraulically controlled backlash compensating device is provided for the lead-screw and gear. A backing-off attachment can be furnished for work up to 18 inches in length. The hydraulically operated wheel-dresser is controlled from the front of the machine.



Ex-Cell-O Precision Thread Grinder for Internal and External Threads

The three-horsepower totally enclosed ball-bearing driving motor and wheel-spindle are mounted in a cradle that can be adjusted for grinding at any angle up to 30 degrees to suit the helix angle of right-hand threads, and up to 45 degrees for left-hand threads. The hydraulic pump, oil filter, and electrical

driving motor are mounted on a cushioned base located at the rear of the machine. Coolant is supplied to the work by a vertical type centrifugal pump driven by a direct-connected electrical motor mounted on the removable coolant tank in the base of the machine. All controls are located on a panel at the front of the machine. Manual controls are also provided, which can be used independently of the automatic controls.

Morris "Mor-Speed" Radial Drill

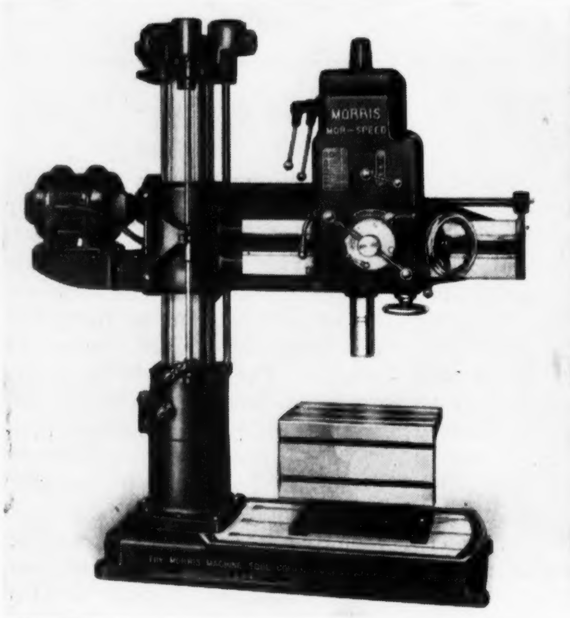
A radial drilling machine made in light- and heavy-duty types, designed for high-speed drilling, facing, boring, and tapping, has been added to the "Mor-Speed" line of the Morris Machine Tool Co., Court and Harriet Sts., Cincinnati, Ohio. This machine has a 9-inch column and is built with 3- and 4-foot arms. Spindle speeds up to 3000 revolutions per minute are obtainable. The drive consists of a constant speed, reversing motor, mounted on the rear of the arm and controlled by a switch built into the lower right-hand corner of the head. This arrangement permits the machine to be started, stopped, or reversed by the switch lever.

The head contains all the speed- and feed-changing mechanism, the changes being made through selective sliding gears on fixed centers. The high-speed spindle driving gears have ground teeth, which insure smooth, quiet operation. Anti-friction bearings are used throughout the machine. A separate motor-driven unit controlled by a single lever provides means for elevating, clamping, and lowering the arm. A motor-driven coolant system mounted on the machine base supplies the required volume of coolant without subjecting it to pressure. Safety features protect the machine from damage, should the operator attempt to engage conflicting feeds or should the tool become stuck in the work.

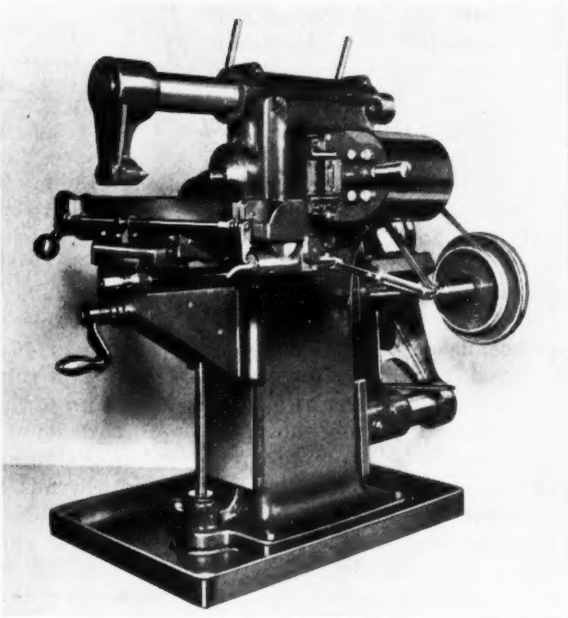
Motor Drive for Burke Milling Machines

A motor drive designed to reduce vibration to a minimum has been brought out by the Burke Machine Tool Co., Conneaut, Ohio, for use on the Nos. 1, 2, 3, and 4 milling machines of this company's manufacture. The Nos. 1 and 3 machines are hand-fed through a rack and pinion, while the Nos. 2 and 4 machines have power longitudinal feeds and screw feeds for the traverse and vertical motions.

The heavy-duty geared-head motor and the conveniently located reversing switch are features of the new drive that facilitate the rapid handling of any size work up to the full capacities of these machines. The standard machines are furnished with extra heavy bronze bearings, adjustable tapered bearings being used at the front end of the spindle and straight bearings at the rear. Anti-friction bearings can be furnished for high-speed work if desired. The efficiency of these machines has been increased by the application of a V-belt drive from the motor to the spindle.



Morris Radial Drilling Machine Built for High-speed Operation

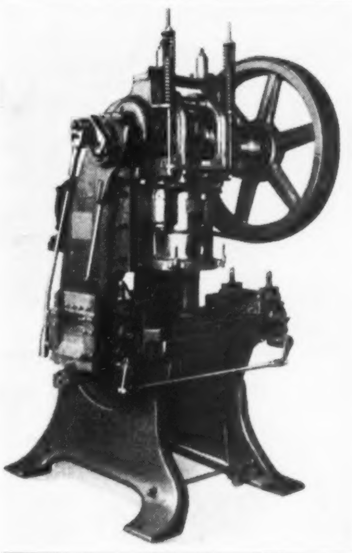


Burke Milling Machine Equipped with New Type Motor Drive

Double Roll Feed and Scrap Cutter for Double-Action Press

A new precision roller clutch, double roll feed, and scrap cutter which are adaptable to any make of open-back inclinable press have been developed by the Callahan Can Machine Co., Inc., 80 Richards St., Brooklyn, N. Y. The accompanying illustration shows this equipment applied to a No. 46 double-action press that is intended for use in feeding coil stock that is cut and drawn into shells.

This feed is designed to convert a standard press into a high-production automatic machine. The rolls are hardened and ground and run on roller bearings. The maximum width of stock that can be fed is 8 inches, and the maximum feeding length is 8 1/2 inches, with a limit of error in the feed accuracy of 0.005 inch at press operating speeds up to 90 revolutions per minute.



Callahan Double-action Press Equipped with Double Roll Feed and Scrap Cutter

Grob Band Saws and Chip Briquetting Machine

The metal band saw equipped with a brazing device shown in Fig. 1 and the open-end band saw shown in Fig. 2 have been added to the line of equipment made by Grob Bros., S. 97th and W. National Ave., West Allis, Wis. The machine shown in Fig. 1, known as Type S-14, has a 14-inch throat and a table 14 by 14 inches. Any standard metal band with a width of from 1/8 to 1/2 inch can be used. For internal sawing on dies and similar work, the band is passed through an opening and brazed. A special grinder is provided for grinding the weld to the proper thickness.

The 19-inch throat open-end band saw, Fig. 2, is similar to the machine described in October, 1935, MACHINERY, page 132, but has several improvements. The saw band, which is 140 feet long, is helically wound on an aluminum drum, as in previous machines, but instead of having a tapered drum with a flat or plain surface, the new machine has a cylindrical drum with a threaded groove that is tapered at the bottom. Only one guide pulley is used above the table, instead of three as before. The machine is completely guarded with swinging doors and removable covers.

A metal chip briquetting machine equipped with a motor drive, as shown in Fig. 3, is another recent development of this company. Metal chips placed in the hopper of the machine are

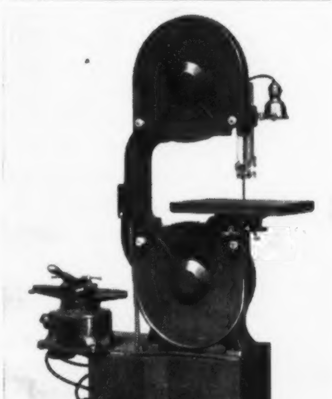


Fig. 1. Grob Metal Band Saw with Brazing Device

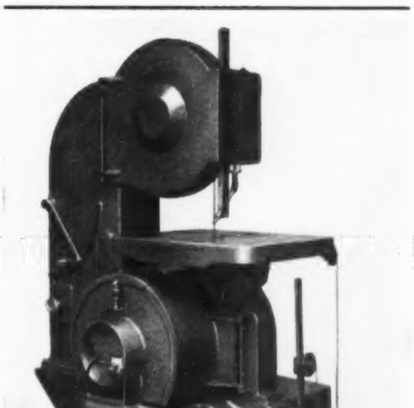


Fig. 2. Grob Open-end Band Saw of Improved Design

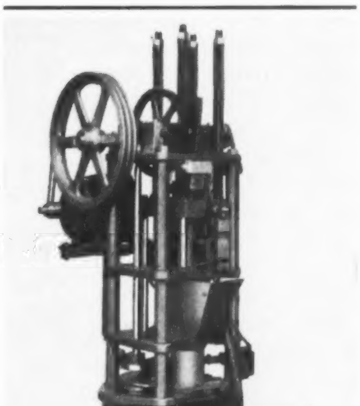
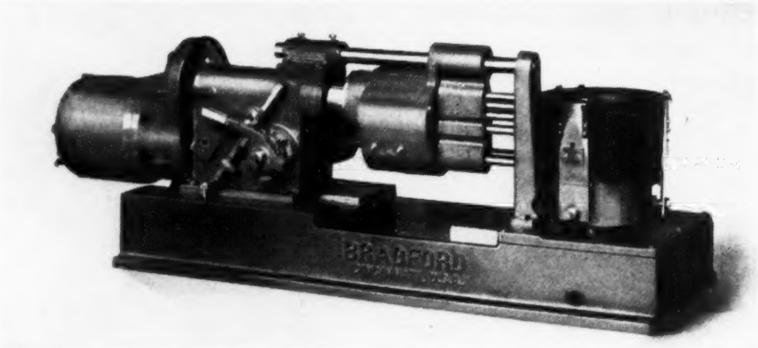


Fig. 3. Hopper-fed Metal Chip Briquetting Machine

fed into hardened steel bushings in a turntable, which is indexed by a Geneva motion to bring the bushings successively into the loading, compressing, and ejecting stations. The lower part of the compressing ram carries a hardened steel plunger which enters the hardened steel bushings. A crank motion carries the ram to its highest point, from which it falls by gravity, assisted by spring pressure.

The machine shown produces briquettes 1 inch in diameter, but machines will be built for the market that will produce briquettes 2 1/2 to 4 inches in diameter. Safety features are provided to prevent damage to any part of the machine in case solid objects are accidentally fed into the hopper.



Bradford Five-spindle Semi-automatic Drilling Machine

Bradford Semi-Automatic Bench Drilling Machine

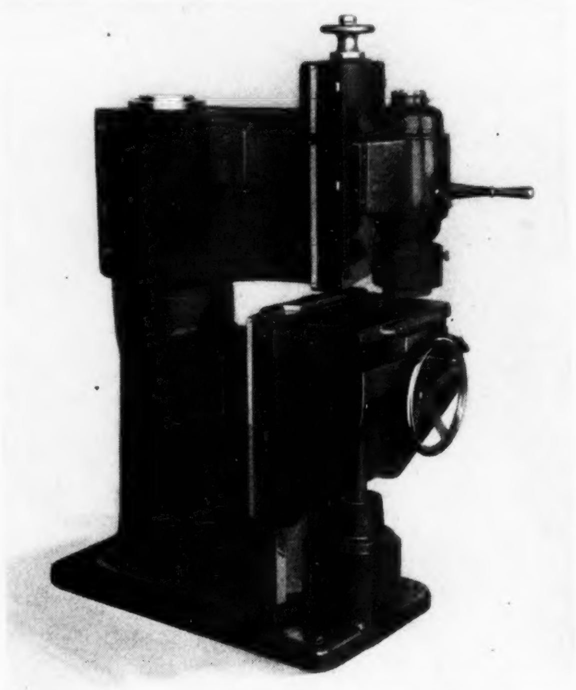
A bench type semi-automatic five-spindle machine for drilling forty-five holes in a Textolite bucket for rayon spinning has been built by the Bradford Machine Tool Co., 657 Evans St., Cincinnati, Ohio. The holes in the Textolite bucket are located in nine groups of five holes each, spaced equally around the periphery of the bucket. Four of the holes in each group are drilled with No. 55 drills, while the fifth hole is drilled with a No. 48 drill. The drill speed is 4000 revolutions per minute.

The operator loads the bucket into the fixture by simply pressing it down into three spring-actuated fingers, and raises the starting lever of the machine. The machine then runs for 45 seconds during which time it drills all the holes, indexing automatically nine times, after which it stops until it is again reloaded and started by the operator.

One of the requirements of the drilling operation is that the holes be cleanly drilled and that they break through into the inside of the bucket without leaving any burrs or defects. This is difficult to achieve with the kind of material drilled. However, the machine described has solved the problem satisfactorily and is giving a production of sixty drilled buckets per hour.

Hanchett Swing-Arm Grinding Machine

The Hanchett Mfg. Co., Big Rapids, Mich., has recently developed the machine here illustrated, in which a grinding wheel that revolves in a horizontal plane is swung by hand back and forth across the work, which is held on a magnetic chuck at the front of the machine. It was developed primarily for grinding off the tops of bottle molds.



Hanchett Grinding Machine with the Wheel Mounted on a Horizontal Swinging Arm

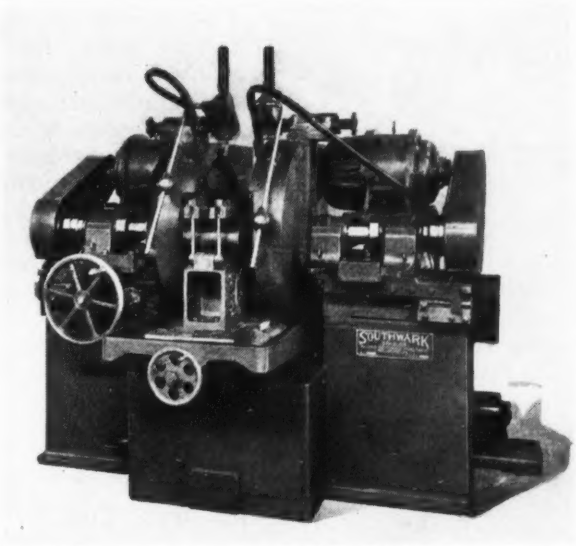
The grinding wheel is driven by a 1 1/2-horsepower motor running at 3600 revolutions per minute. The motor and wheel unit are mounted on a vertical slide provided with a micrometer-screw hand feed. The wheel is 5 inches in diameter by 3 inches high and has a 3-inch center hole. The magnetic chuck measures 8 by 16 inches. The knee type work-table can be adjusted to various heights to suit the work. When the grinding wheel is new, the maximum distance from the top of the 4-inch high magnetic chuck to the under side of the wheel is 14 inches. This machine weighs approximately 2500 pounds.

Spring Grinding Machine

The ends of helical springs are ground parallel and to length in the machine here illustrated, which was recently built by the Baldwin-Southwark Corporation, Philadelphia, Pa. While intended primarily for spring service, the machine can also be used for grinding square surfaces on other parts that are within the limits of its capacity.

The machine is equipped with two opposed grinding heads driven by individual motors which run at the same constant speed. These motors drive the grinding-wheel spindles through gearing. The wheels are 22 inches outside diameter by 14 inches inside diameter. Either a hand or a mechanical feed can be provided to bring the wheels closer together or farther apart, as the operation may necessitate.

The table travels back and forth between the grinding wheels, being actuated by a separate motor. The table stroke is adjustable to suit the length of the work. Coolant is circulated to the wheels by a motor-driven pump in the machine bed. A wheel-truing device is supplied. Welded construction is employed throughout.



Baldwin-Southwark Machine which Grinds Opposite Sides of Work Parallel

Dilks Automatic Plate-Perforating Machine

Accurately spaced holes in a circular spiral formation, such as required in television scanning disks, can be pierced at the rate of 240 holes per minute on an automatic machine placed on the market by the Dilks Research Laboratories, Inc., 172 Lafayette Ave., Passaic, N. J. Machines of the same design are built in different sizes, ranging from the small size used for perforating 6-inch disks of light material up to the large machines employed for blanking coins from plates 24 inches in diameter. The largest machines weigh as much as 500 pounds, whereas the smaller machines, such as the one shown in Fig. 1, may weigh only 350 pounds. The speed of operation varies according to the work performed.

The machine illustrated is used for piercing the master plate shown in Fig. 2. This plate is used in the manufacture of disk motion pictures. It has 2400 holes, 3/32 inch in diameter, spaced 3/32 inch apart in a spiral formation. One of these disks is perforated in ten minutes, the operation being entirely automatic from the time the blank disk is placed on the work-spindle until the holes are pierced and the machine stopped. In the case of machines used to produce coin blanks from plate stock, the blanks are stacked automatically in tubes, from which they are fed to the embossing machine.

The disk to be perforated is placed on the vertical spindle, as shown in Fig. 1. This spindle remains in a fixed position, but is indexed intermittently to obtain the required spacing of the holes, while at the same time, the unit carrying the punch and die is moved along its supporting rails the distance necessary for the spiral arrangement of the holes. This combination of a rotary indexing movement of the work and a radial movement of the punching unit with respect to the work is obtained in the following manner: On the up stroke of the piercing punch, a picker unit driven by the punch ram shaft through miter gears and shafts, actuates a picker pin, causing it to rise, enter the pierced hole and rotate or index the plate and the spindle on which it is mounted.

This intermittent indexing movement, which occurs after

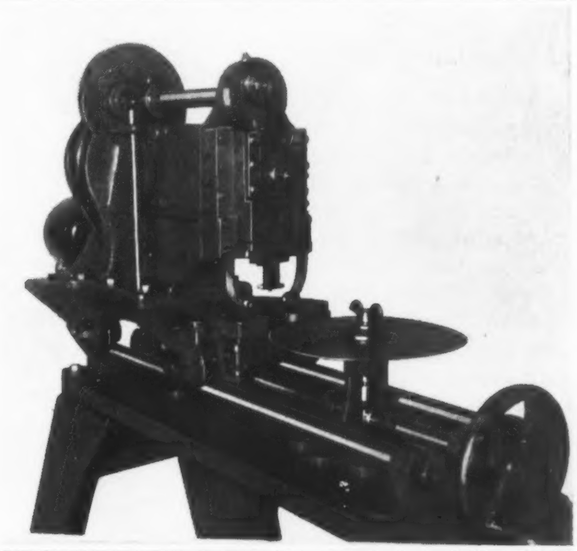


Fig. 1. Dilks Automatic Plate-perforating Machine, Made in Wide Range of Sizes

each piercing stroke, simultaneously imparts the feeding movement to the punching unit, causing it to move along its supporting rails. The latter movement is transmitted from the work-spindle through miter gears which drive a feed-screw located between the rails that support the punch unit.

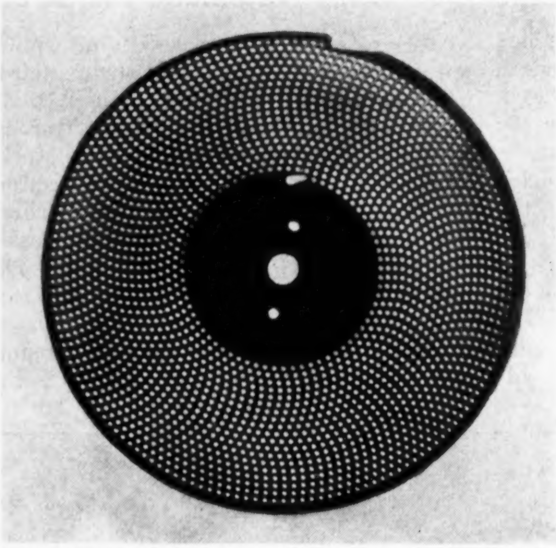


Fig. 2. Master Plate Perforated on Machine Shown in Fig. 1

Ellicott Motorizing Unit

A motorizing unit, which makes it possible to provide an individual motor drive for almost any type of machine equipped with a cone pulley, has been developed by the Ellicott Machine Co., 153 W. Howard St., Pontiac, Mich. This unit can also be used wherever it is necessary to make a speed reduction from the motor to a countershaft, and it can be readily changed from a lathe to any other machine in its size range.

The original countershaft bearings, as well as the shaft and cone pulley of the machine, are generally used with the motorizing equipment. The unit has been designed to eliminate the old lineshafting and thus permit the machines to be placed where they will take up the least space and provide the best lighting.

Chucks for Landis Pipe Threading and Cutting Machine

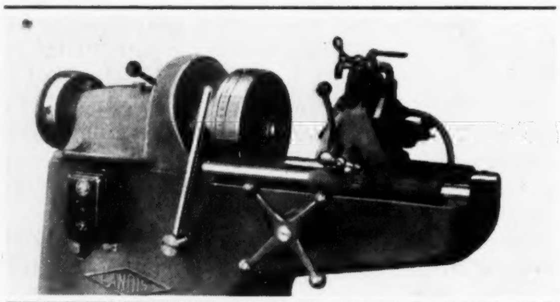
A lever-operated front chuck and a rear centering chuck have been developed by the Landis Machine Co., Waynesboro, Pa., for the "Little Landis" 2-inch pipe threading and cutting machine. This machine has previously been furnished only with a three-jaw universal front chuck and no rear chuck, which still remains standard equipment.

Should speedier operation and additional support for the pipe be desired, the lever-operated front chuck and rear centering chuck shown in the illustration can be supplied. The lever-operated chuck has universal adjustment and is graduated for all diameters of pipe within its range of 1/4 to 2 inches. Simply loosening one locking nut permits the chuck to be changed to the required size in a few seconds.

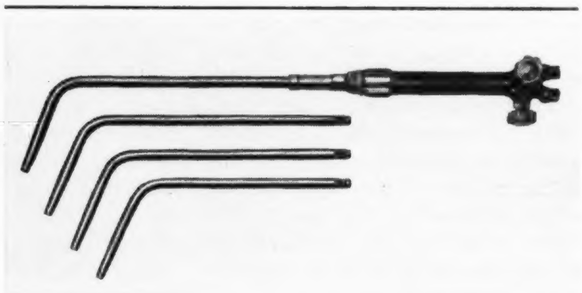
The rear centering chuck is of the three-jaw universal type, and has a knurled ring for manual operation, so that no wrench is required. This chuck does not grip the work tightly, but is intended only for centering and supporting the pipe. The rear centering chuck can be applied to machines now in service. The lever-operated front chuck, however, must be built into the machine.

"Weldmaster" Torch

A light-weight welding torch known as the "Weldmaster" has been added to the line of Meco oxy-acetylene welding equipment made by the Modern Engineering Co., St. Louis, Mo. This torch, with a standard tip, weighs only 17 1/2 ounces, and is claimed by the makers to be the lightest torch on the market. A new alloy that can be forged,



Landis Pipe Threading Machine with New Chuck Equipment



Welding Torch which Weighs Only 17 1/2 Ounces

extruded, and heat-treated and that has the tensile strength of mild steel is used in the construction.

The circle mixer employed in all Meco torches is used on the new torch. This mixer has been improved and its capacity has been increased so that the largest tips can be used efficiently with low gas pressures. Other features are spring-tension wheel handles which assure permanent adjustment even with rough handling; fluted design for the wheel handles, and a thin grip having wide fluting. The grip has an electrically applied blue finish, while the remainder of the handle is a contrasting silvery type alloy.

Firth "Braze-Rite" Furnace for Applying Carbide Tips

An electrically operated hydrogen brazing furnace designed especially for the tipping of sintered carbide cutting tools has been brought out by the Firthite Division of the Firth-Sterling Steel Co., McKeesport, Pa. This furnace, known as the Firth "Braze-Rite," is provided with two separate muffles, each of 2-inch capacity, for brazing carbide blanks to steel shanks. The heat is localized at the end of the tool on which the carbide blank is to be mounted. This feature eliminates the necessity for heating the entire shank, thus saving time, as well as heating current. Tools varying in size from small bits up to those having shanks 1 1/2 inches square can be accommodated.

Brazing is done in a hydrogen atmosphere to prevent oxidation of the carbide tip and the steel shank, as well as the brazing material. Hydrogen is admitted through openings at the rear of each muffle, the amount being controlled by valves located at the rear of the furnace. The recess of the tool to be tipped is covered with flux and the shank preheated in the furnace. It is then withdrawn so that the sintered carbide blank and copper brazing material can be set in place, after which it is returned to the furnace, where it remains until the copper has melted. The tool is then withdrawn slightly, so that the tip can be firmly pressed into position in the manner shown in the illustration.

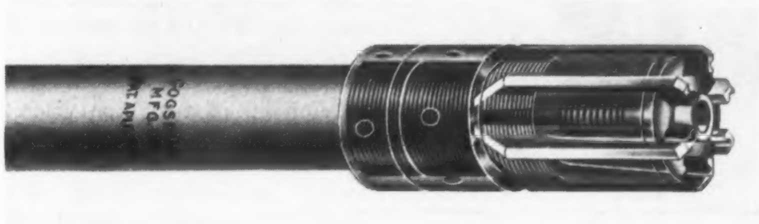
Brazing Carbide Tip to Steel Shank in Firth "Braze-Rite" Furnace

The furnace can be furnished for operation on either direct or alternating current. A direct-reading pyrometer is mounted at the rear of the furnace. The electrical control permits correct temperature to be maintained at all times. The furnace is provided with a complete set of tools for brazing, including tongs, shears, scraper, and tip presser. The metal-top table shown is furnished as optional equipment.

Cogsdill Inserted-Blade Adjustable Reamers

To meet the demand for an adjustable inserted-blade reamer of simple design which would have long life and be capable of adjustment while in service, the Cogsdill Mfg. Co., Inc., Detroit, Mich., have developed the "spline lock" construction shown in the illustration. This blade-locking arrangement, the result of exhaustive investigation, is used in a line of chucking type high-speed steel reamers now being placed on the market in sizes varying by 1/16-inch increments from 1 to 3 inches in diameter. These reamers are made in both the taper- and straight-shank style.

When the blades become dull or expansion is necessary, the spline-lock retainer screw at the front end of the reamer is loosened sufficiently to relieve the pressure against the blades. Next, the lock-nut for the adjusting nut at the rear end of the blades is loosened. The blades are then moved forward to expand them by turning the adjusting nut to the right. The adjusting nuts are graduated to insure accurate adjustment, each graduation representing 0.001



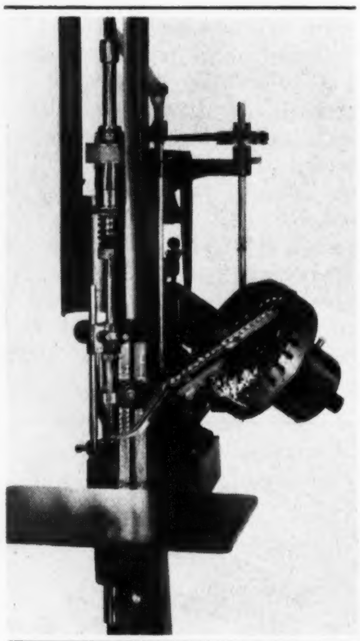
Cogsdill Inserted-blade Reamer

inch expansion. The blades can be expanded and reground many times before they are worn out, and they can be easily replaced.

Power Screwdriver with Magazine Feed

A power screwdriver with a magazine feed which automatically carries the screws from a universal barrel type hopper to the driving bit has been brought out by the Detroit Power Screwdriver Co., 5365 Rohns Ave., Detroit, Mich. With this equipment, the screws are simply dumped into the hopper, after which operation of the foot-lever brings a screw in line with the rotating bit by which it is engaged and driven to any desired tension. The hopper has a capacity for feeding screws in sizes from No. 4 to 1/4 inch in diameter, and embodies features that make it especially adaptable for feeding screws of short lengths having large-diameter heads.

The illustration shows the machine with the hopper ring cut away to present a clear view of the rotating collector ring, which picks up the screws from the mass held in the hopper and delivers them to a point in line with the storage tracks of the magazine feed. The inside baffle plate is provided with a screw guide which directs the screws from this point into the storage track. When the track becomes filled with screws, an adjustment of the inner collector ring to and from the storage track allows the screws to be carried past the end of the track without jamming or disturbing those that have already entered the track.



Power Screwdriver with Barrel Type Hopper Feed

A motor at the rear of the machine drives the spindle and the hopper, the drive to the hopper being through reduction gears that run in an oil bath. A friction clutch, adjustable to any desired tension, rotates the driving bit, which engages and disengages the screw slot in such a manner that small brass screws can be driven at high speeds without any possibility of marring the heads. All working parts of the machine are accessible, and the change-over from one size screw to another can be accomplished in a few minutes.

Armstrong Vise and Portable Stand

A combination pipe vise and stand, in which the vise forms an integral part of the stand, has been brought out by the Armstrong Mfg. Co., Bridgeport, Conn. The vise will take 1/8-inch to 2 1/2-inch pipe, and the stand is equipped for bending pipe of any size up to 3/4 inch. An oil-can recess and slots for wrenches, cutters, or stock, and the three folding legs of the stand are all incorporated in one unit. A chain is attached to the unit for securing or holding the legs together when the stand is folded.

A choice of two pipe vises is offered. One vise has the three regular jaws, while the other has broad jaws which grip along their entire length without marring the pipe. A new feature is the anti-friction bearing in the form of a hardened steel disk between the screw and the upper jaw. This bearing increases the life of these parts and enables the pipe to be clamped tighter with less effort. The I-beam construction combines strength with light weight.

Armstrong Portable Pipe Vise with Supporting Stand

Improved Radial Hydraulic Pumps

A complete series of Model 4R radial pumps of improved design has been brought out by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. These pumps are similar in appearance to the one described on page 683 of June, 1933, MACHINERY, but their design represents a radical departure from previous designs built by this company, both in principle and construction.

Experience has shown that the efficient operation of radial type pumps depends on the close clearance between the central distributing valve pintle, which is a stationary shaft-like member and the cylinder rotor which revolves around it. A close clearance between these members is essential for the maintenance of high oil pressure with moderate oil leakage. Consequently the prevention of metal-to-metal contact and the wear that invariably follows has depended entirely upon the maintenance of an unbroken film of oil as the only sep-

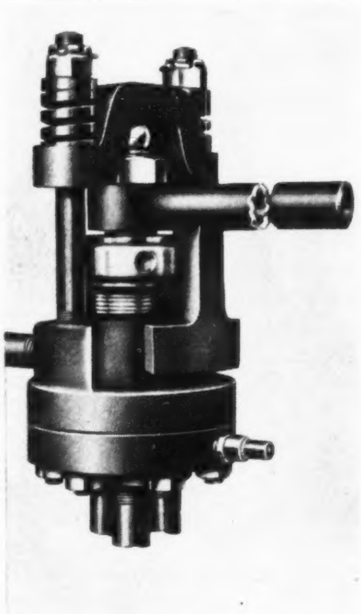
arating medium between these two parts.

In the new pumps this disadvantage has been overcome by the improved mechanical relationship between the valve pintle and cylinder rotor, which assures the positive positioning of these parts.

Nicholson Hydraulic Valves

A balanced valve for oil or water service up to 5000 pounds pressure has been brought out by W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa. This valve, known as Style H, is made in two-, three- and four-way types. The balanced feature permits the valve to be operated easily and yet remain tight under high pressures. Water hammer or shock is avoided by the design, even when the valve is turned on or off quickly.

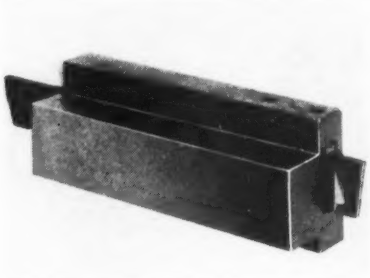
The three- and four-way types are made in six sizes with pipe tap connections ranging from 1/4 inch to 1 1/4 inches. The two-way or straight-through type is made in six sizes with pipe tap connections from 1/2 inch to 2 inches.



Nicholson Balanced Valve for Oil or Water Service

Four-Grip Holder for Cut-Off Blades

A cutting-off blade holder designed specifically for use on the four-way turret on the cross-slide of turret lathes has recently been added to the line of the Four-Grip Tool Co., 107 E. 17th St., Paterson, N. J. The body of the holder is designed to be held firmly on the turret-head by means of set-screws. The tool blade is rigidly gripped in the holder by socket type set-screws in such a way that the blade can be quickly removed for re-sharpening and easily replaced. The advantage of this type of cutting-off tool is a large saving in the amount of high-speed steel required, as only the blade itself is made of that material.



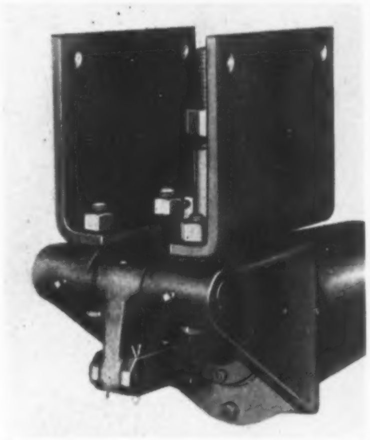
Four-grip Cut-off Blade Holder for Turret Lathes

Holders of this type are made in various sizes to suit blades ranging from 1/8 by 11/16 inch by 6 inches long up to 5/16 inch by 1 11/16 inches by 12 inches.

Electrically Controlled "Air Operator" for Power Press Clutches

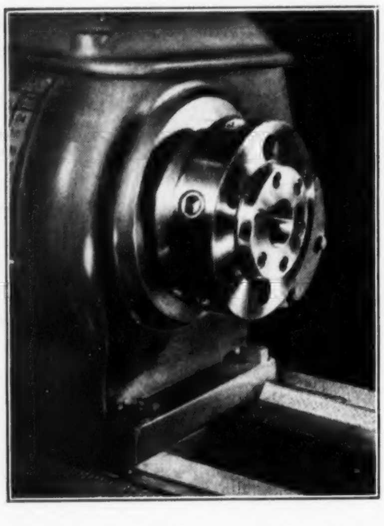
In some plants having power presses equipped with manually operated friction clutches and brakes, it is customary to employ men whose only duties consist of operating the clutch levers. In other plants, the clutches are operated by men who help load and unload the press. These manual operations result in lost production time.

With the electrically controlled "air operator" built by the Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio, each man working on the press can be provided with one or more hand- or foot-operated control buttons, so arranged that the clutch can be engaged only when all the buttons are depressed. With this device, it is not necessary for any operator to wait until the others are ready before pressing his control button. Also, the press ram can be stopped at any time by any operator. Thus, there is little or no delay between operations.



Device for Operating Power Press Clutches

The electrical equipment is usually furnished with a four-position selector for momentary, long, inching, and continuous operation. In the momentary position, the press makes one revolution and automatically stops on the top center, when all the buttons are depressed momentarily and immediately released. With the long-stroke position, all the buttons must be held down until the slide reaches a predetermined position on the down stroke; the buttons are then released, which causes the press to complete its revolution and stop at top center. With this electrically controlled air trip on the friction clutch and brake, the shifting is done so rapidly and the clutch and brake are set for such quick action that there is a minimum of slip and consequently very little wear.



Hardened Cam-lock Spindle Nose Used on Monarch Lathe

Cam-Lock Flanged Spindle Nose for Monarch Lathes

The principal advantage of the new cam-lock flanged spindle nose now available, if desired, on all 12- to 18-inch engine and tool-room lathes made by the Monarch Machine Tool Co., Sidney, Ohio, is the speed with which chucks, plates, and fixtures can be clamped to the spindle nose or removed. Another important feature is the clamping arrangement, which is designed to prevent the chucks and fixtures from working loose, even under the most severe operating conditions.

The spindle nose shown is the size used on all lathes from 12 to 18 inches, so that all chucks, etc., will interchange on all machines within this range. The flange nose is 7 1/8 inches in diameter. All dimensions are the same as those adopted for certain sizes of turret lathes and for some automatic lathes. Chuck manufacturers are now in a position to furnish steel body chucks machined to fit the cam-lock spindle nose without the use of an adapter plate.

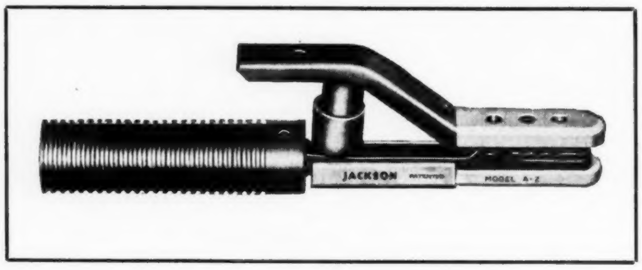
"Durakool" Mercury Switches for Machine Tools

A line of mercury switches adapted for use in automatic, electrically controlled machine tools and electrically operated hydraulic equipment has been developed by the Bucklen-Bear Laboratories, Inc., 1010 N. Main St., Elkhart, Ind., and is being manufactured and sold by Durakool, Inc., of the same address. These switches, known as "Durakool," are made in six sizes, ranging in capacity from 1 to 200 amperes. This range of sizes makes possible the mounting of a switch of the proper capacity at each point requiring current control, thereby eliminating many mechanical parts, intermittent relays. and magnetic contactors.

The switches are so designed that the opening and closing points remain the same throughout the life of the switch, a feature that particularly adapts them for use in calibrated mechanisms. The operating angle or the annular movement between the opening and closing points is less than 4 degrees. The metallic envelopes of the switches are filled with a vapor which, it is claimed, will not leak out or be absorbed by metallic parts.

Jackson Arc-Welding Electrode-Holder

A completely insulated welding electrode-holder with replaceable jaws of "Mallory 3 metal" has been brought out by the Jackson Electrode Holder Co., 6553 Woodward Ave., Detroit, Mich. This holder, like previous types made by this company, is designed to permit air circulation between the insulation and metal to insure cool operation. A special copper alloy is used for the structural parts of the holder that combines strength with adequate conductivity. The material used for the replaceable jaws is a copper alloy that is already widely used for spot-welding tips, flash-welding dies, and seam-welding wheels.



Jackson Insulated Electrode-holder with Replaceable Jaws

Ideal Commutator and Slip-Ring Resurfacing Stones

Three new grades of commutator and slip-ring resurfacing stones, known as Ideal No. 81, and a new super-polisher have been added to the line made by the Ideal Commutator Dresser Co., 1214 Park Ave., Sycamore, Ill. The resurfacing stones are made especially for grinding steel and cast-iron slip rings, and are furnished in coarse, medium, and fine grades. The new super-polisher is intended for finishing copper and bronze commutators, on which it produces a brilliant, smooth finish.

"Contrasit" Belt Pulley Bandage

A covering for belt pulleys designed to eliminate belt slippage and undue strain on bearings, which has been used for the last four or five years in European plants, is now being introduced in this country by K. V. Wissing, Scann-American Sales Service, 200 Broadway, New York City. A test run showing 13.70 belt slippage feet with plain pulleys showed only 3.08 slippage feet on "Contrasit" covered pulleys.

Teco Steel Cutting Carbide Composition

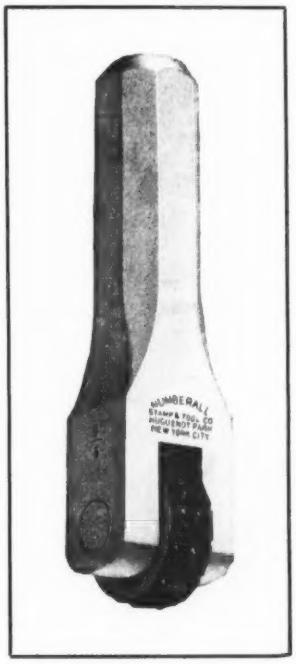
The Tungsten Electric Corporation, 540 39th St., Union City, N. J., has developed a grade of Teco especially adapted for machining steels. It is claimed that the destructive effect of cratering is overcome by the method of manufacture and that the high thermo-conductivity of the material prevents overheating.

Numberall Heavy-Duty Rotary Stamp

A rotary type of numbering stamp intended for the deep stamping of iron, steel, bronze, and other metals, whether in the form of bars, sheets, castings, or ingots, is being placed on the market by the Numberall Stamp & Tool Co., Inc., Huguenot Park, Staten Island, N. Y. This stamp has the advantage of providing a full set of numbers, the letter X and a dash, all in one tool. It will therefore do the work of eleven separate character stamps.

All characters are indicated on the front side of the wheel, so that any number can be easily located. Changes in settings are made by simply turning the wheel with the thumb and forefinger. The weight of the stamp is less than one-half that of a set of single figure stamps; however, it is sufficient to permit heavy-duty use.

As the stamp consists of three pieces, the blows are delivered indirectly on the work. It is claimed that, because of this, a much deeper mark can be made with a single blow than when a blow of similar force is struck on a solid single-figure stamp. Extra numbering wheels can be furnished, but the wheel is designed to last as long as the hammer-steel shank.

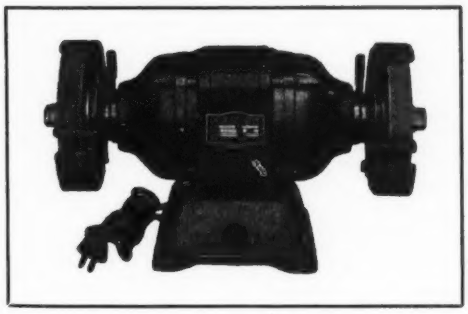


Numberall Stamp with a Full Set of Numbers

This rotary stamp can be supplied in sizes with numbers from 1/4 to 1 inch in height.

"Handy" Heavy-Duty Bench Grinder

A heavy-duty ball-bearing bench grinder, equipped with 6- by 1-inch wheels protected by heavy cast-iron guards and driven by a capacitor type, 1/2-horsepower motor, has been added to the line of "Handy" grinders made by the Baldor Electric Co., 4357 Duncan Ave., St. Louis, Mo. The motor of this grinder is designed to withstand heavy overloads, even to the point of frequent stalling. The tapered end plates allow room for grinding large work.



"Handy" Bench Grinder Intended for Heavy Duty

Does Industry Again Face Regimentation?

A booklet entitled "Business Again Faces Regimentation" has been published by Allen W. Rucker, in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn. The booklet calls attention to the fact that both labor and industry seem to be unaware that the Walsh Bill, if enacted, will give the Secretary of Labor dictatorial powers over both business and labor.

The bill places in the hands of the Secretary of Labor absolute power to control wages and hours, not only of those who directly sell to the Government, but also of those who furnish materials and supplies used by contractors to the Government.

Its provisions mask its economic significance and lead many to suppose that they will not be affected because they do not sell directly to the Government. The bearing manufacturer, for example, may sell nothing to the Government; but if the makers of electric motors, automobiles, and other products using his bearings accept Government business, then the Secretary of Labor can dictate the wage and hour policies of his business. Hence, manufacturers must either be willing to accept a dictatorship of the Department of Labor, or find customers who never sell directly or indirectly to any Government agency, if that can be done.

The Walsh Bill gives the Secretary of Labor power to set wages and hours. These wages and hours may be, at the discretion of the Secretary, different for the various sections of the country and for various industries, and may be changed from time to time as he (or she) dictates. It gives the Secretary power to investigate industry at will, and determine findings which are conclusive on all buying departments of the Government. In other words, it creates a complete dictatorship of industry. Is American industry ready for a dictatorship?

Grinding Thrust Bearing Plates for Derricks

The grinding of a combination of internal and external conical surfaces and a flat surface, using the same grinding wheel for all three surfaces, is an unusual and interesting job accomplished on the Heald surface grinding machine equipped as shown in Fig. 1. The ground part or work shown in Fig. 2 is a thrust bearing plate used to carry the excessive thrust load in derricks. All surfaces of this plate are ground to reduce friction to a minimum.

In this case, the machine shown is used to grind the internal conical surface *A*, the blind external conical surface *B*, and the flat surface *C*, as indicated in Fig. 2. The grinding wheel, in order to grind the surface *B*, which is blind at the outer edge, must necessarily have its axis at an angle, so that the portion of the wheel in contact with the work will have the same projected radius as the radius of the work at that point. In order to grind both the internal and external conical surfaces at the same setting, the wheel must present two cutting surfaces.

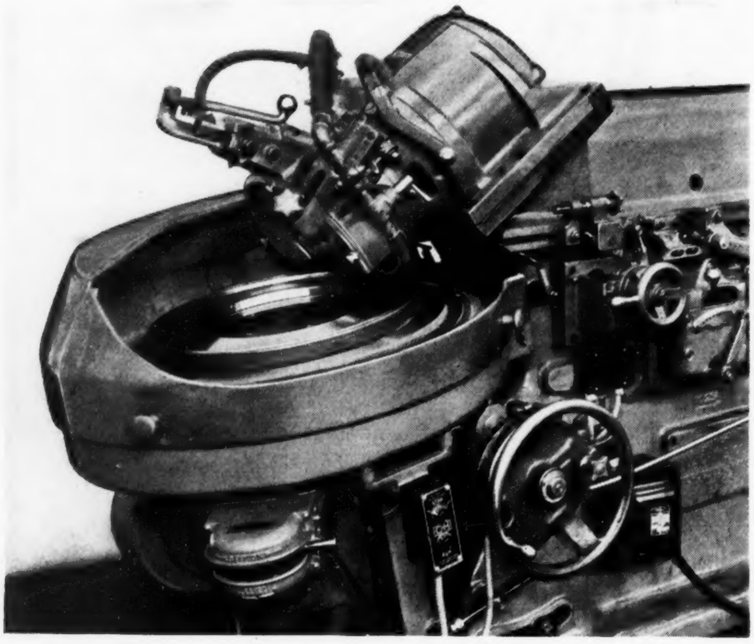


Fig. 1. Set-up for Grinding Surfaces A and B, Fig. 2, at One Setting of the Work

The wheel-head and driving motor are independent units and are mounted at the correct angle on the front end of the ram. Two diamond wheel-truing units are mounted on slides attached to the water guard and are operated independently by hand-levers for truing the two faces of the grinding wheel. A facing attachment is used in grinding the face *A*. This attachment consists essentially of a hand-operated wheel which is integral with a stop that contacts with a dog mounted on the ram.

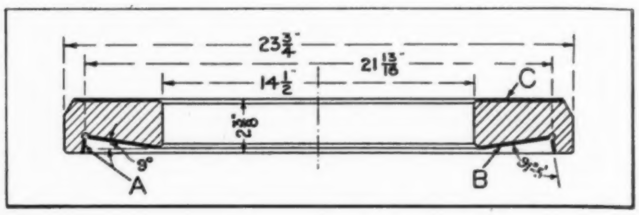


Fig. 2. Derrick Bearing Plate Ground on Surfaces A, B, and C with Equipment Shown in Fig. 1

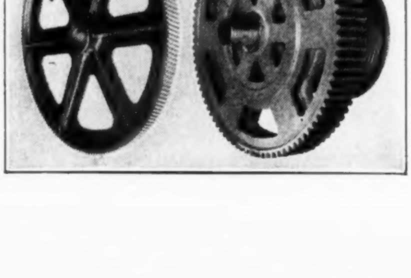
The ram traverse is hydraulically actuated, but is accurately controlled by the hand-wheel. A graduated dial on the wheel facilitates grinding the work to close tolerances. The upper flat face *C* is ground first. The bore is then ground on an internal grinder. Next the work is centralized on the magnetic chuck of the grinding machine by means of a ground plug in the bore, after which the chuck bracket is adjusted to the same angle as the surface *B*, which is then ground. The final operation consists of grinding the surface *A*, using the facing attachment.

* * *

A Social Security Program Without Government Coercion

A correspondent writes us as follows: "One section of the annual report of the Armstrong Cork Co. is well worth quoting: 'In addition to the maintenance of sound and fair wage scales, your company's policy toward its employes includes the eight-hour day; time and a half pay for over-time; a forty-hour week with no one permitted under any circumstances to work more than forty-eight hours; one day's rest in seven, with no exceptions; vacation with pay for wage-earners, as well as salaried workers; a pension system for superannuated employes; sickness, permanent disability, and group life insurance; and finally, a limited system of unemployment benefits for 1936, applying to all wage-earners who have been in your company's employ for a year or more.' It may be added that this company has had no labor troubles."

Gears welded from rolled steel are now used in electric traveling cranes built by the Harnischfeger Corporation, Milwaukee, Wis. Light weight and high resistance to wear and strains



are advantages claimed. Also, special steels can be selected for members that will be subjected to high stresses, replacements are easier and casting flaws are eliminated.